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Assessment of the implementation of the IPPC directive

Final report (issue 6) - contract number
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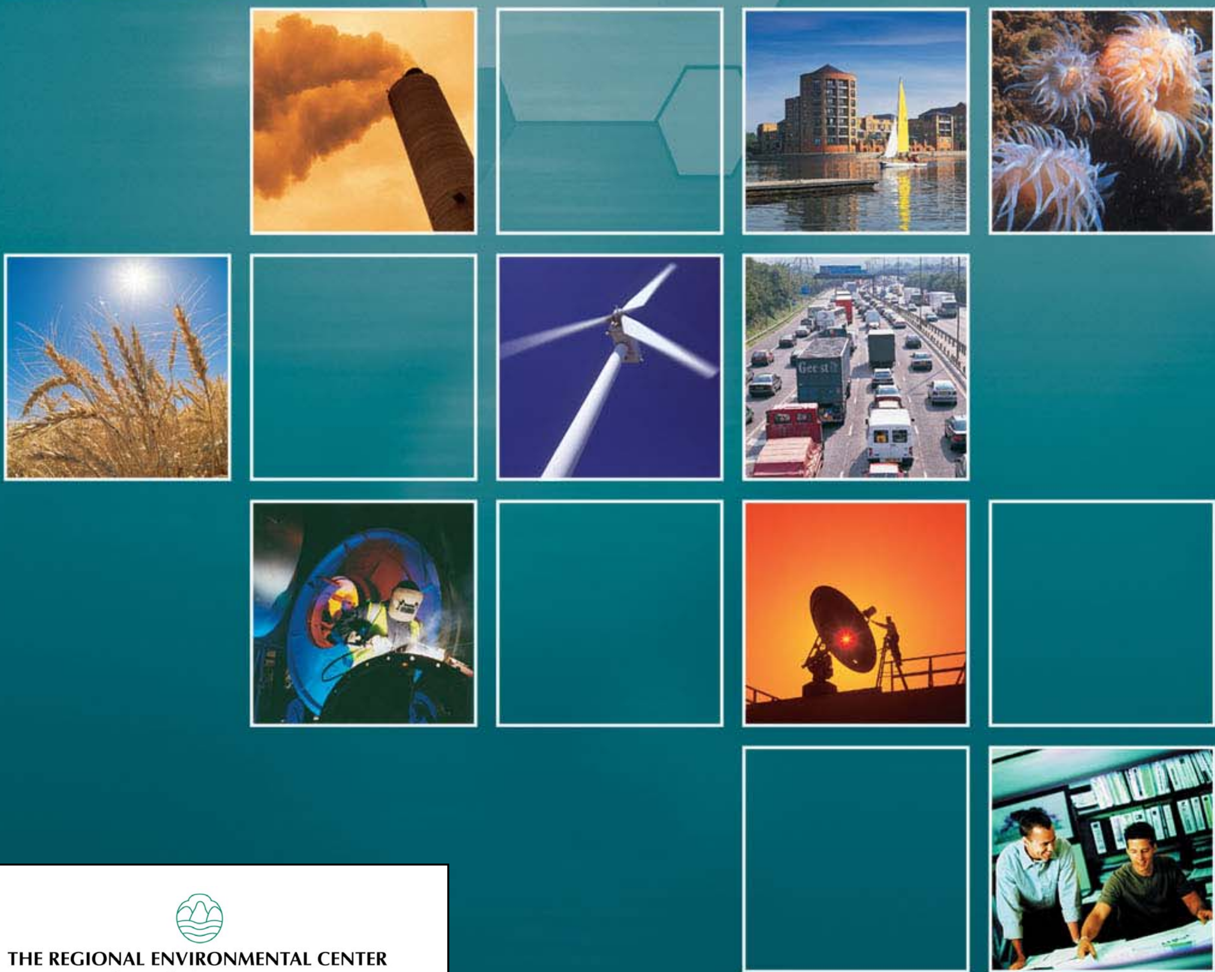

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Executive summary

Acknowledgements

We would like to express our thanks to all of the organisations and individuals that have contributed their time, expertise and information to this project. This includes representatives from IPPC installations, Member States, competent authorities, trade associations, the European Commission and various other experts, both in terms of the case studies undertaken and in the workshop organised for the refineries sector.

Project background

DG Environment contracted Entec UK Limited, in association with Arcadis Belgium and the Regional Environmental Center for Central and Eastern Europe (REC), to undertake an assessment of the implementation of Directive 2008/1/EC concerning integrated pollution prevention and control (the IPPC Directive).

The overall aim of the study was to assess the implementation of the IPPC Directive by Member States through the use of installation-specific case studies focusing on how the requirements of the Directive have been implemented. The main tasks covered in this report are[1]:

- Assessment of 20 individual case study installations across five different industry sectors selected on the basis of a methodology developed by the contractor and the Commission (Task 2); and
- Assessment of the state of implementation of the IPPC Directive in the mineral oil and gas refinery sector including the analysis of 11 individual case study installations (Task 3).

This study builds upon previous work completed by the Commission and others. It is envisaged that the results of this study, including the case studies and the wider general findings, will help to provide the Commission with greater insights into how the IPPC Directive is being implemented and the key factors that have influenced implementation. The results are expected to help the Commission better understand the quality of implementation in various sectors and Member States now that the deadline for issuing IPPC permits has passed.

The Commission wanted to understand where problems exist in implementation and to identify whether there are any horizontal issues (for Member States or sectors) that may need to be addressed. Where possible, conclusions in this report are drawn from installation-level data on whether issues identified apply horizontally, though given the number of case studies included for these tasks (31 main case studies), it is acknowledged that the conclusions drawn might be indicative rather than representative.

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1 Task 1 of this project assessed the implementation of the IPPC Directive for certain individual installations subject to questions from the European Parliament, complaints or petitions. The results of this exercise are not included in this report.

This report sets out the main results and outputs of the work undertaken. It comprises:

- An analysis of the information collected and an assessment of permits for installations under Task 2;
- An assessment of specific installations as well as a general sector evaluation for the mineral oil and gas refineries sector; and
- Overall conclusions on the findings for both of the above.

The purpose of this report is to provide support to the Commission in its policy decision-making.

The case study installations are intended to be illustrative and the assessments are not intended to be a check on compliance with the IPPC Directive. As such, no reference to individual installations or the employees of such installations is provided in this report. The individual case study assessments have been provided in draft to the relevant operators and authorities for comment and to correct any possible areas of misunderstanding.

Methodology

The case studies that form the major part of this assessment have been undertaken with the intention of providing answers to the following main questions:

- Have permits been issued or updated in accordance with the IPPC Directive?
- Are the installations selected currently operating in accordance with their permits and are the best available techniques (BAT) being applied?

A series of more detailed questions and a standard template for capturing and reporting on this information was developed in agreement with the Commission.

Based on a methodology agreed with the Commission[2], 20 installations were selected for Task 2 covering five industrial sectors: printed circuit board manufacture; coal-fired large combustion plant; iron and steel production (focusing on blast furnace and sinter plant); nitric acid manufacture and NPK/CN fertiliser manufacture. Twelve installations were selected for Task 3 on the refineries sector; however, the assessment only covers eleven refinery

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2 The methodology involved selection of a sample of Member States and sectors. Member States were selected taking into account (a) the desire to include a geographical balance of Member States, (b) significance of overall sectoral emissions/discharges at a Member State level, (c) the estimated number of IPPC installations, (d) inclusion of Member States not covered in previous similar studies, (e) consideration of different competent authorities involved in the process and (f) the presence of national guidance for determining BAT. Selection of sectors for Task 2 took into account (a) environmental impacts of the sectors including emissions reported in EPER, (b) sectors with clear conclusions in the BREFs, (c) sectors where previous studies indicated differences between permit conditions and BAT-AELs, (e) sectors not previously studied and (f) coverage of a range of IPPC activities.

installations because an IPPC permit was not issued in time for inclusion for one of the selected installations. The installations, covering both Task 2 and Task 3, are located in eleven Member States[3].

These case studies were developed through a review of relevant documentation on the installation (IPPC permit, emissions monitoring data and, where available, permit applications and the authorities' decision documents produced when preparing the permits). This desk-based review was followed by site visits with the operators and competent authorities (with the exception of a small number that were not able to take part[4]). The assessment of the case studies has focused on the main environmental impacts associated with the sectors concerned.

For the five sectors covered by Task 2, broad conclusions have been drawn at a sector level regarding issues associated with implementation (this is provided in Section 3 of this report). For the refineries sector, a general evaluation of implementation of IPPC in the sector was undertaken, based on: a review of relevant literature; a workshop bringing together experts from industry, authorities and other relevant bodies with practical experience of implementing IPPC in the sector; and a thorough assessment of relevant data on the sector (such as the EPER database, publicly available environmental reports for 63 installations, refineries surveys and various other statistics). These were used to supplement the assessments of individual installations.

The number of installations assessed in each sector and each Member State is shown in the table below.

	Belgium	Czech Republic	France	Germany	Greece	Italy	Nether-lands	Poland	Slovakia	Spain	UK	Total
Surface treatment of metals and plastic (Printed Circuit Board manufacture)						1					1	**2**
Combustion installations (coal-fired power plants)					1	1	1	1	1	1	1	**7**
Iron and steel production (sinter plants & associated blast furnaces)						1	1		1	1		**4**
Production of basic inorganic chemicals (nitric acid manufacture)						1	1			1		**3**
Fertiliser manufacture (NPK/CN)						1	1		1	1		**4**
Mineral oil and gas refineries	1	1	1	1	2	*	1	1	1	1	1	**11**
Total	**1**	**1**	**1**	**1**	**3**	**5**	**5**	**2**	**4**	**5**	**3**	**31**

* Note that this installation was originally included but was not assessed because the permit was not issued within the timescales of this project.

3 Belgium, Czech Republic, France, Germany, Greece, Italy, the Netherlands, Poland, Slovakia, Spain and the UK.

4 For three installations the operator did not take part in the interview/site visit and in one case the competent authority did not take part.

Quantitative results of individual case studies

A number of detailed questions were addressed for each of the case study installations. Section 5.2 of this report provides a summary of the results for the questions where it is possible to provide a quantitative overview of the results. This covers installations covered by Tasks 2 and 3 of the study. Highlights from this analysis include:

- For more than half of the installations studied, the main IPPC permits[5] were only issued in either 2007 or 2008. This has implications for the extent to which it has been possible to assess performance of the installation against the conditions of their permit and also for the extent to which the requirement to comply with IPPC, through the permits, has influenced performance compared to BAT as set out in the BREFs.

- Consideration has been given to the permit determination process including: whether there was suitable dialogue between the operator and the Competent Authority during the permit determination process; whether co-ordination was required between Competent Authorities; whether there were any disagreements between the operator and Competent Authorities during permit development; and whether additional information was required prior to permit determination. Whilst not necessarily statistically significant, the following conclusions can be drawn from these data:

  - For installations where there were disagreements between the operator and competent authority, the average time taken for permit development was 15 months, compared to 8 months where there were no reported disagreements;

  - For permit applications where additional information was required, the average time taken for permit development was 12 months, compared to 8 months where there was no reported need for additional information.

- The permits for all of the installations covered contain at least some emission limit values (ELVs), equivalent parameters or technical measures or reference to general binding rules containing such conditions. However, there were four cases where ELVs had not been set for key pollutants or key parts of the installation.

- For only two of the installations, all ELVs contained in the permits were consistent with the range of emission levels associated with application of the best available techniques as defined in the BAT reference documents (BAT-AELs). The remaining 29 installations had some but not all permit ELVs in line with the BAT-AEL ranges.

- However, for the majority of installations, the BREFs were at least taken into account by the competent authority in setting permit conditions (16 installations). For 6 of the installations, it appeared that the BREFs were not taken into account in setting permit conditions and for the

[5] For several of the case studies, there are multiple permits governing control of the installations under IPPC. This assessment has focused on certain key aspects of the permits/installations, such as particular parts of the activities involved (such as blast furnace and sinter plant for iron and steel installations) and on permits/processes with the greatest potential for environmental effects.

remainder the picture was mixed (4 installations) with some conditions set based on a consideration of the BREFs, or unclear (5 installations)[6].

- For the majority of installations (25), there was evidence of consideration of specific technical characteristics of the installation, its geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters. In some cases, this led to setting ELVs or other conditions that were either more or less stringent than BAT as specified in the BREFs[7]. However, in other cases, whilst such factors were taken into account, this did not lead to setting less or more stringent conditions.

- For five installations, there appeared to be evidence of factors influencing permit conditions not compatible with the Directive (e.g. the operator's economic circumstances).

- For 26 of the 31 installations, general binding rules (GBRs) were applied to the installations, specifying various operational requirements, in some cases including many parameters (including ELVs), but in others relatively small numbers of parameters (such as specific monitoring requirements) were applied. There was variability amongst Member States in terms of the extent to which these GBRs were based on the BREFs and BAT-AELs.

- For 22 of the 31 installations, information was included within the permits themselves on when the permits will be reconsidered. For 6 installations, the period specified was five years or less and for a further 15, the period was between six and ten years (the period for the remaining one installation was longer than ten years).

- The permit application, decision document[8] (where applicable) and the permit itself were available to the public for 30 of the 31 installations. Monitoring records were available to the public for 24 installations (with the situation unclear for a further six). This information was made available 'actively' in some cases – such as on a website – and upon request in other cases.

- In terms of the type of monitoring carried out (i.e. the parameters monitored and the monitoring frequency), emissions monitoring undertaken for 23 of the installations appeared to comply fully with the permit requirements, whilst for two installations the situation was unclear (based on the

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6 For example, in some cases draft versions of the BREFs seem to have been used (where final versions were not available at the time of permit application/determination). In other cases, it was not clear from the documentation made available (including the permit emission limit values) or the interviews with competent authorities/operators whether or how the BREFs have been taken into account.

7 It is noted that taking into account factors such as local environmental conditions appears to be interpreted in different ways for different installations. For example, the lack of an expected significant impact of an installation on the local environment has been used in some cases as a basis for setting permit ELVs that are less stringent than those achievable through use of BAT as set out in the BREFs. Conversely, a potentially significant impact on the local environment, taking into account other nearby sources of emissions, has been used in some cases as a basis for setting permit ELVs or other conditions that are more stringent than the techniques and BAT-AELs set out in the BREFs.

8 A document setting out the competent authority's rationale in assessing the operator's permit application and determining/setting permit conditions.

information and views provided for this assessment) and for a further six the picture was mixed (meaning that there were some instances for each installation where monitoring did not appear to comply fully with the permit requirements).

- In terms of actual levels of emissions, based on the monitoring data provided, emissions from the installations appeared to comply with all permit emission limit values for 16 installations[9], with mixed levels of compliance with permit emission limit values for 12 installations. For three of the installations the situation was unclear, mainly because some monitoring data was not available for certain key aspects.

- For six installations, all available emissions data were consistent with the emission levels associated with the best available techniques as defined in the relevant BREFs, with a mixed picture (some emissions meeting these levels) for 20 installations and an unclear picture for five installations[10].

- Ten of the installations were inspected by the competent authority four or more times in the year up to when the assessment was undertaken, while eight were not inspected during that period. The level of detail of the inspections (in terms of time spent and environmental aspects considered) appeared to vary significantly.

- For six installations, sanctions or other measures have been applied in cases of non compliance with the permit conditions. In five cases, these included warning letters from the competent authority to the operator (for factors such as pollutant emissions in excess of permit ELVs and failure to undertake improvements/surveys in a timely manner). In one of these five cases, the warning was followed by variations to the improvement programme for the installation (temporarily allowing a higher emission limit value for one pollutant). In a further one case, it is understood that a fine has been issued where emissions of one pollutant exceeded the permit limit value. In other cases, it is understood that no further action was taken.

A summary of some of the key conclusions for each of the 31 permitted installations covered in this study is provided in the table below.

9 Noting that monitoring data provided did not necessarily cover every emission point for all installations.

10 In some cases, emissions monitoring and permit ELVs are not directly comparable with the BREF BAT-AELs, such as where annual mass emission limits are specified in permits and concentration-based emission levels are associated with BAT as set out in the BREFs (and directly comparable emission monitoring data were not made available).

Installation and reference number	1) Permit includes Emission Limit Values (ELVs) or equivalent?	2) Are ELVs consistent with BAT AELs?	3) Emissions consistent with BAT-AELs?	4) Emissions comply with permit ELVs?	5) Local conditions considered in setting conditions?	6) Permit available to the public?
Surface treatment (PCB manufacture)						
Italy (02/IT/18)	Mixed	Mixed	Mixed	Yes	No	Yes
United Kingdom (02/UK/25)	Yes	Mixed	Yes	Yes	Yes	Yes
Large combustion plant (coal and lignite fired)						
Greece (02/EL/12)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Italy (02/IT/22)	Yes	Mixed	Unclear	Unclear	Yes	Yes
Netherlands (02/NL/14)	Yes	Yes	Yes	Mixed	Yes	Yes
Poland (02/PL/30)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Slovakia (02/SK/15)	Mixed	Mixed	Mixed	Yes	Yes	Yes
Spain (02/ES/33)	Yes	Mixed	Mixed	Mixed	Unclear	Yes
United Kingdom (02/UK/34)	Yes	Mixed	Mixed	Yes	Yes	Yes
Iron and steel (blast furnace and sinter plant)						
Italy (02/IT/29)	Yes	Mixed	Yes	Yes	Yes	Yes
Netherlands (02/NL/02)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Slovakia (02/SK/03)	Yes	Mixed	Mixed	Yes	Yes	Yes
Spain (02/ES/31)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Nitric acid manufacture						
Italy (02/IT/09)	Mixed	Mixed	Mixed	Yes	No	Yes
Netherlands (02/NL/28)	Yes	Yes	Yes	Mixed	Yes	Yes
Spain (02/ES/32)	Mixed	Mixed	Mixed	Yes	Yes	Yes
Fertiliser (NPK/CN manufacture)						
Italy (02/IT/23)	Yes	Mixed	Yes	Yes	No	Yes
Netherlands (02/NL/24)	Yes	Mixed	Yes	Yes	No	Yes
Slovakia (02/SK/07)	Yes	Mixed	Mixed	Unclear	Yes	Yes
Spain (02/ES/08)	Yes	Mixed	Mixed	Yes	Yes	Yes
Oil and gas refineries						
Belgium (03/BE/13)	Yes	Mixed	Unclear	Yes	Yes	Yes
Czech Republic (03/CZ/02)	Yes	Mixed	Mixed	Mixed	Yes	No
France (03/FR/12)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Germany (02/DE/16)	Yes	Mixed	Mixed	Mixed	No	Yes

Installation and reference number	1) Permit includes Emission Limit Values (ELVs) or equivalent?	2) Are ELVs consistent with BAT AELs?	3) Emissions consistent with BAT-AELs?	4) Emissions comply with permit ELVs?	5) Local conditions considered in setting conditions?	6) Permit available to the public?
Greece (03/GR/14)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Greece (03/GR/17)	Yes	Mixed	Unclear	Unclear	Yes	Yes
Italy (03/IT/15)	N/A	N/A	N/A	N/A	N/A	N/A
Netherlands (03/NL/07)	Yes	Mixed	Unclear	Yes	Yes	Yes
Poland (03/PL/08)	Yes	Mixed	Unclear	Yes	Yes	Yes
Slovakia (03/SK/09)	Yes	Mixed	Mixed	Yes	Yes	Yes
Spain (03/ES/10)	Yes	Mixed	Mixed	Yes	Yes	Yes
United Kingdom (03/UK/11)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Totals						
Yes	27	2	6	16	25	30
No	0	0	0	0	5	1
Mixed	4	29	20	12	N/A	N/A
Unclear	N/A	0	5	3	1	0
Total	31	31	31	31	31	31

Note: Full questions were as follows:

1) Does the permit include ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBRs (Article 9(8))?

2) Are emission limits from the installation consistent with BAT-AELs (where defined) in the relevant BREF documents?

3) Are current emissions from the installation consistent with BAT-AELs (where defined) in the relevant BREF documents?

4) Do the current emissions from the installation comply with the permit ELVs?

5) Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?

6) Are/were the application/decision document and permit available on a public register?

Summary of overall conclusions for the refineries sector

Section 5 of this report presents the outputs of an assessment of the implementation of the IPPC Directive in the mineral oil refineries sector, both in terms of the findings for the case study installations included in this study and in terms of a general sector evaluation. The main conclusions, based on both of these, are set out below[11].

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[11] It is noted that the analysis of only one permit per Member State for the refinery sector (two in Greece) does not necessarily allow for representative conclusions to be drawn on the implementation of the IPPC Directive in the mineral oil and gas refineries sector for those specific Member States.

- The implementation of the IPPC Directive in the mineral oil and gas refineries sector started relatively late and, based on the installations assessed, significant progress in the permitting process in some Member States was only made in the period 2006 to 2008. This is supported by the installation-specific findings and other work on review of permitting progress.

- All of the permits for the 11 case study installations include ELVs or equivalent parameters or technical measures or reference to GBRs.

- None of the installations had *all* ELVs contained in the permits consistent with the BAT-AELs. Of the 145 ELVs (for emissions to air as well as water) that could be assessed, 72 were consistent with the corresponding BAT-AELs, 72 were not and for 1 ELV it was unclear.

- From the installation-specific findings, it is clear that GBRs – which are sometimes based on the national transposition of other EU legislation such as the LCP Directive or the national programmes for reduction of emissions under the NEC Directive – are used to set ELVs for emissions to air in some Member States considered (PL, ES, EL).

- Technical (e.g. age of the plant) and economic limitations and the apparent good quality of the local environment were stated by operators and/or competent authorities in some cases as a justification for not imposing ELVs that are consistent with the BAT-AEL ranges; but the full rationale behind the choice for less stringent ELVs has not always been provided (so the number of cases where such approaches have been applied cannot be quantified).

- In four of the eleven cases, the permit or other supporting documentation showed how BAT was taken into account in setting permit conditions. There were two cases where this was not the case, three cases where the picture was mixed and two cases where this was unclear.

- In 10 of the 11 cases, there was evidence of consideration of specific technical characteristics of the installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters. In some cases, this led to setting ELVs or other conditions that were either less or more stringent than BAT as specified in the BREFs. However, in other cases, whilst such factors were taken into account, this did not lead to setting less or more stringent conditions.

- In two of the cases, there was evidence of factors influencing permit conditions not compatible with the Directive (e.g. operator's economic circumstances).

- For 10 of the 11 installations the permit contained release monitoring requirements that covered the full requirements of Article 9(5)[12].

- None of the installations provided monitoring data indicating that all emissions were within the BAT-AEL ranges. For seven out of eleven installations, however, emissions to air and/or water were

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12 Suitable release monitoring requirements, specifying measurement methodology and frequency, evaluation procedure and an obligation to supply the competent authority with data required for checking compliance with the permit.

consistent with at least some of the BAT-AEL ranges, while for the remaining four the situation was unclear.

- Five out of eleven installations that were considered in the installation-specific assessment operate in line with all of their permit conditions for emissions to air and water. Monitoring data provided indicate that a further five installations achieved emissions within some permit ELVs but not others.

- As part of the general sector evaluation for the refineries sector, an analysis of the case study installations as well as emissions data from other sources was undertaken. This involved a consideration of the total emissions expressed as "load bubbles", both for individual installations and at a country-wide level[13]. Key findings from this analysis include:

  - Regarding emissions to air, a wide variation of the total emissions expressed as load bubbles is obvious, both for individual installations as well as on a country-wide level[14]. Differences in the measured "load bubbles" cannot always be explained by refinery complexity and/or crude slate used. This suggests that legal requirements such as permit conditions set by Member States and/or GBRs also have a major influence on emissions to air.

  - Whilst it is apparent that progress in lowering the emissions to air has been made over recent years for SO_2 and NO_x, a significant number of installations are exceeding the annual load bubble benchmarks specified in the BREF document. This is confirmed by both the sector-wide analysis (80-90% of the installations exceed the SO_2 and 60-70% exceed the NO_x load bubble benchmarks) and the installation-specific findings.

  - Regarding emissions to water, concentrations and load bubbles also vary widely on an individual installation level, but a significantly larger share of installations already meet the load bubble benchmarks specified in the BREF document compared to the situation with emissions to air.

- Provisions related to abnormal operating conditions, site closure measures, protection of soil and groundwater and monitoring of emissions were governed by GBRs in 7 out of 11 installations.

- The setting of BAT-based ELVs in the refinery sector is often not straightforward as in many cases a petrochemical plant (covered by the large volume organic chemicals BREF) is heavily integrated with the refinery. The numerous split views on BAT-AELs in the refineries BREF document also do not contribute to a swift/consistent use of the BREF's conclusions in setting permit conditions and this has been used as a justification not to impose ELVs in line with the BAT-AELs by certain competent authorities. Clearer conclusions in the updated refineries BREF document would therefore be likely to

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13 Load bubbles represent the mass of pollutant emissions per mass of crude oil processed. Refinery capacity has been used as a surrogate for the latter in several instances in this assessment as the actual mass processed was not always available for refineries that were not covered by the 11 case studies. The refineries BREF includes 'benchmarks' for emissions load bubbles. Whilst these benchmarks do not have the same status as BAT-AELs, they do provide a useful basis for comparisons between installations and between Member States.

14 By way of example, at a Member State level, the load bubbles for SO_2 varied from around 30 to 1,300 t/Mt throughput in 2006. The corresponding variation for NOx was 70 to 350 t/Mt throughput.

help improve the usability of the BREF and thus to ensure a more consistent implementation of the IPPC Directive across the EU.

Limitations and uncertainties

Whilst all reasonable efforts have been made to undertake the assessments of individual installations and to obtain all of the information in the data collection templates developed for this project, there are a number of factors that have influenced the level of information that is available and hence the extent to which full conclusions can be drawn. These include:

- Limitations on the amount of time available for investigating each issue for each installation. Whilst the desk-based reviews prior to site visits in most cases allowed the site visit interviews to focus on the main outstanding issues, in several cases, information needed for the assessments was either only made available at the time of the site visit or made available afterwards, allowing less opportunity to explore specific issues. This also means that the level of information available for the different installations varies.

- Some of the sectors and installations studied are highly complex. Furthermore, the processes for permitting of some of these installations prevented the undertaking of a full assessment of all aspects of the installation (for example, there are several tens of IPPC permits for some of the individual installations examined and these could not all reasonably be reviewed within the time and resources available).

- There was significant variability amongst the case study installations in the availability, transparency and quality of the data provided. In particular:

  - Applications and permit decision documents were made available for some, but not all, of the installations (in some cases, the applications were made in the 1990s; for some installations no formal decision documents exist).

  - Furthermore, the permits themselves varied considerably in terms of level of detail. As can be seen from the quantitative conclusions above, a number of the installations were bound by GBRs rather than specific permit conditions. Whilst the key conditions of many of these GBRs were reviewed, it was not possible to undertake a full review of all conditions of all of these GBRs (especially where translation was necessary).

  - Similarly, the level of information available on emissions monitoring was highly variable. In some cases, emissions data available from the competent authorities only included total mass emissions to air and water and in several cases the data provided did not include details of the averaging periods used, both of which make comparison of emissions with permit ELVs and BAT-AELs problematic. In some cases, competent authorities did not have more detailed monitoring data whilst in some others there was a reluctance to provide such data.

- In some cases, it was difficult to compare actual installation performance with permit conditions because the data available did not lend themselves readily to such a comparison. In particular, for some of the installations where permits were issued only a short time before the assessments were undertaken, the available monitoring data did not always correspond with permit conditions.

Creating the environment for business

Contents

1. Introduction

1.1 Project background

The original Integrated Pollution Prevention and Control (IPPC) Directive[15] was adopted in September 1996 with all Member States being required to bring it into effect by 30th October 1999. The Directive was recently codified as Directive 2008/1/EC[16].

The Directive applies an integrated environmental approach to the regulation of certain industrial activities, which means that emissions to air, water and land plus a range of other environmental effects must be considered in the issuance of a permit in compliance with the Directive. It also requires that competent authorities in Member States must develop and set permit conditions for operation of installations falling within the regime so as to achieve a high level of protection of the environment as a whole. Permit conditions must be based on the use of Best Available Techniques (BAT), which are defined in the Directive as the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole.

The ability for Member States to take into account the installation's geographical location, site-specific technical characteristics and local environmental conditions as well as the requirement to engage, consult with and enable contributions from members of the public in the setting or permit conditions, are also important characteristics of the Directive.

The Directive is not only concerned with the prevention of pollution during the operational lifetime of an installation but also requires that provisions are made to protect the environment upon cessation of the industrial activity concerned and for the restoration of the site of the installation to a satisfactory state.

The deadline for full implementation of the requirements of the IPPC Directive in Member States was 30th October 2007, at which point Member States should have ensured that all existing installations were operating in accordance with integrated permits that meet the requirements of the IPPC Directive. For some of the newer Member States, transition periods were incorporated into the relevant Accession Treaties for a number of individual installations, allowing for longer timescales in implementing certain aspects of the Directive.

15 Council Directive 96/61/EC concerning integrated pollution prevention and control, OJ L257, 10.10.1996, pp. 26-40.

16 OJ L24, 29.1.2008, pp. 8-29.

1.2 This study

DG Environment contracted[17] Entec UK Limited, in association with Arcadis Belgium and the Regional Environmental Center for Central and Eastern Europe (REC), to undertake an assessment of the implementation of the IPPC Directive. The requirement for this project arose as a result of:

- Previous studies examining how industrial emissions legislation was being implemented (including an assessment of the implementation of the IPPC Directive[18]) and areas for potential improvement;
- The passing of the deadline for implementation of the Directive at the end of October 2007. Since relevant installations should have had a permit in place, there was a need to focus on the quality of the permits in place and the implementation of the legislation;
- The Commission issued an Action Plan on implementation of legislation on industrial emissions as part of its Communication 'Towards an improved policy on industrial emissions'[19]. The Plan recognised the need to ensure that Member States apply the current legislation to the fullest extent possible, by strengthening its monitoring and supporting mechanisms. Actions of particular relevance to the current study include:
    - Supporting Member States in their implementation of the legislation, including aspects of enhanced information exchange, guidance development, visits to authorities and training.
    - Enhanced monitoring and compliance checks on the application of the legislation, including investigating the system of monitoring and inspection at IPPC installations, covering specific industrial installations and sectors, the use of general binding rules and the analysis of complaints.

On 21 December 2007 the Commission adopted a proposal for a Directive on industrial emissions (IPPC) that recasts the IPPC Directive and associated legislation on industrial emissions. However, **the focus of this study was on implementation of the current legislation**.

The overall aim of the study was to assess the implementation of the IPPC Directive by Member States through the use of installation-specific case studies focusing on how the requirements of the Directive had been implemented. With this in mind the project considered three main tasks:

1. Assisting the Commission to assess the implementation of the IPPC Directive for certain individual installations subject to complaints, petitions or questions from Members of the European Parliament;

[17] Under framework contract number ENV.C.4/FRA/2007/0011.

[18] http://circa.europa.eu/Public/irc/env/ippc_rev/library?l=/implementation_entec&vm=detailed&sb=Title.

[19] COM(2007) 843 final.

2. Assessing 20 case study installations across five different industry sectors to gain understanding of the practical implementation of the Directive in the Member States and the issues faced for different IPPC activities and

3. Assessing the state of the implementation of the IPPC Directive in more detail for one particular sector and across a larger number of Member States. The sector chosen in this particular case was the mineral oil and gas refinery sector. This task included the assessment of 12 case study installations.

The over-arching objective of the study was to build on previous work completed by the Commission and others in the assessment of the effectiveness of Member States implementation of the IPPC Directive and to present the Commission with a series of case studies examining implementation issues.

The study identifies where problems exist in implementation and where horizontal issues may need to be addressed. Conclusions have been drawn from the installation-level data. The remit of the project does not necessarily allow for wider conclusions to be drawn and so further investigations may be required to determine whether the problems apply more widely. Given the remit of the work, it is acknowledged that the conclusions drawn might be indicative rather than representative.

1.3 Purpose of this report

This report sets out the main results and outputs of the work undertaken. Based on the specification for the work and subsequent discussions with the Commission, the report provides:

- Assessment of 20 individual case study installations across five different industry sectors selected on the basis of a methodology developed by the contractor and the Commission (Task 2).

- Assessment of the state of implementation of the IPPC Directive in the mineral oil and gas refinery sector (Task 3).

Task 1 of this project assessed the implementation of the IPPC Directive for certain individual installations subject to complaints, petitions or questions from the European Parliament. The results of this exercise are not included in this report.

The purpose of this report is to provide support to the Commission in its policy decision-making. The results of the study are not intended to be used by any other party in making financial or policy decisions.

The case study installations are intended to be illustrative and the assessments are not intended to be a check on "compliance" with the IPPC Directive. As such, no reference to individual installations or the employees of such installations is provided in this report. The individual case study assessments have been provided in draft to the relevant operators and authorities for comment and to correct any possible areas of misunderstanding.

1.4 Scope of the tasks covered in this report

1.4.1 Installations selected on the basis of a methodology developed by the contractor and the Commission (task 2)

The scope of this task was to provide technical support to the Commission in assessing at least 20 specific installations, which were selected using a methodology developed by the contractor in conjunction with the Commission. The installations were selected in order to cover a range of different main activities, located in different Member States. They were also selected on the basis of, *inter alia*, emissions data from the European Pollutant Emission Register (EPER), the general environmental impacts of the installations concerned and the availability of BREFs for the activities of the installations concerned.

Work under this task involved collection of data relating to the permit application, permit and monitoring data for each installation and performing an assessment of these against the criteria detailed in Section 2.1.

The assessment process primarily consisted of a two-stage approach with a desk-based review of documentation (with follow-up communications with site operators or competent authorities where appropriate) followed by a face-to-face interview with both the site operator and the relevant competent authority. The scope of this task was:

- To assess data from sources including, *inter alia* EPER and, in cooperation with the Commission, to select a suitable number of Member States, industry sectors and installations to short-list as candidates for potential participation in the study;
- To contact the relevant short-listed competent authorities and installation operators, supported by a suitable introduction to the study from the Commission, and to recruit them as study participants;
- To obtain relevant documentation from each Member State competent authority and/or installation operator;
- To undertake such work as was necessary to interpret the main elements of the documentation so as to enable an evaluation in accordance with the key requirements of the IPPC Directive;
- To undertake a series of interviews with installation site operators and relevant competent authorities; and
- To draft a suitable response to the Commission in the form of a template report so as to communicate the key findings of the assessment for each individual installation selected, specifically answering the questions to be answered (Section 2.1).

1.4.2 Assessment of the state of implementation of the IPPC Directive in the mineral oil and gas refinery sector (task 3)

The scope of this task was to conduct an assessment of the current state of implementation of the IPPC Directive across a sector, specifically focussing in this case on the mineral oil and gas refinery sector.

The evaluation builds upon the study undertaken by Petroleum Development Consultants (PDC)[20] in 2004 that considered the progress being made to implement IPPC for the sector by 2007. The PDC study indicated a high degree of variation of performance across refinery installations and low implementation of BAT. Emissions data in the EPER database also indicated a broad range of specific emissions between Member States and between individual refineries within a Member State in the EU15, which may indicate a non-uniform implementation of the IPPC Directive in this sector.

The inclusion of a detailed assessment for this sector also builds upon the Commission’s previous announcement that a follow up assessment on implementation of IPPC would be made for mineral oil and gas refineries.

It is also recognised that mineral oil and gas refineries can have significant environmental impacts and a detailed sector wide evaluation incorporating implementation of the Directive across a larger number of Member States falling within one clearly defined activity description. This provides a good basis for identifying both the benefits and problems that exist in the implementation of the current legislation, particularly with regard to the clear BREF conclusions for this sector. The work included:

- A wide-ranging literature search on the sector, which included an assessment of, *inter alia*, the EPER database and a sector-specific workshop used to gather information from installations, trade organisations, Member States and others and

- A suitable number of site-specific case studies (12) selected from a representative number of Member States and completion of a similar evaluation process to that for task 2.

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[20] Petroleum Development Consultants (2004) “Study contract for investigation of EU refineries' compliance with the Directive on combating of air pollution from industrial plants”.

2. Methodology

2.1 Questions to be addressed for all tasks

2.1.1 Overview

For each of the three tasks, the work involved: installation-specific assessments to address the content of the permit; the procedures followed to establish that permit; and the actual operation of the installation in relation to the permit conditions and BAT (from the relevant BAT Reference Documents, BREFs).

The aim was to provide answers to a number of questions. The questions to be addressed were the same for all three tasks and are detailed in the following sections. However, the focus within each task was on the specific issues related to either the nature of the complaints received (task 1) or to the issues related to the sectors or Member States in which the installations fall, such as particular environmental issues (tasks 2 and 3).

2.1.2 Investigation of procedures used and conditions set for selected permits

This part of the study encompasses a number of different elements but is essentially asking the question: **Have existing and new permits been issued or updated in accordance with the IPPC Directive?**

In order to answer this question, a series of sub-questions were set out to be assessed on an installation-by-installation basis. These questions were set out by the Commission as follows:

- To what extent does the information provided by the applicant in relation to Article 6 appear to be comprehensive and accurate?
- What are the main permit conditions (emission limit values and other parameters and measures according to Article 9(3) of the Directive or general binding rules according to Article 9(8))?
- Are they demonstrably based on BAT according to Article 9(4) of the Directive?
- How have the relevant BREFs been taken into consideration during the setting of permit conditions?
- Were any trade-offs made to balance different environmental impacts (such as emissions to different media)?
- Is there any evidence of any factors having influenced the permit conditions which are not compatible with the Directive (e.g. consideration of the economic circumstances of a particular operator)?
- Was there any reference to the need to comply with environmental quality standards under Article 10 of the Directive and did this affect the permit conditions laid down?

- Are there monitoring requirements and an obligation to supply the competent authorities with data required for checking compliance with the permit (Article 9(5))?
    - How detailed are these requirements?
    - Do they take into consideration the relevant BREFs?
    - Does the permit include information on the duration over which the monitoring should be undertaken?
- Has the permit (or the relevant general binding rules) already been reconsidered or when will it be reconsidered and where necessary updated (Article 13)?
- Was public participation and access to documents in accordance with Article 15 provided for?

2.1.3 Assessment of the actual installation operations when compared to permit conditions and to BAT

This second element of the assessment was concerned with seeking an answer to the following: **Are the installations selected currently operating in accordance with their permits and with BAT?**

By directly reviewing the actual operations within case-study installations, it is possible to draw conclusions as to whether those installations are operating in accordance with the Directive and the reasons for any areas in which they may deficient. This latter point is particularly important as the Directive allows conditions to be set on a site-specific basis given an assessment of the local environmental and geographical conditions. The focus of the assessment was to address the following questions:

- What were the emissions of the installation before the implementation of the conditions of the permit?
- What is the current emission monitoring performed by the operator (including parameters and frequency)?
- How does it comply with the permit conditions and how does it relate to BAT in the relevant BREFs?
- What are the current emissions of the installation?
- Does the installation comply with the emission limit values and other conditions of its permit?
- Have sanctions or other measures been applied in cases of non-compliance with the permit conditions?
- How many on-site inspections by competent authorities have been carried out during the last 12 months and is this typical for this installation?
- How does the current performance of the installation compare with BAT, in particular the BAT associated emissions levels determined in the relevant BREFs?

- What are the expected future improvements to the performance of the installation?
- Are measures foreseen to ensure that, at the cessation of activities, the site of operation is returned to a satisfactory state?

2.2 Overview of process for assessment of installations

Assessment of individual installations for tasks 2 and 3 involved providing technical support to the Commission in assessing specific installations (20 installations for task 2 and 12 for task 3[21]). These installations were selected on the basis of a methodology developed and agreed in conjunction with the Commission. Details of the methodology used are provided in sections 2.3 and 2.4.

It was recognised that it was unlikely, given the small sample size, that it would be possible to draw conclusions on a sector or Member State level. However the outputs of the assessment are intended to provide the Commission with a useful indicative view on the relative implementation of IPPC by a typical installation within defined industry sectors or Member States.

A list of sectors (for task 2) and Member States (for tasks 2 and 3) was developed in agreement with the Commission. This list was presented to the meeting of the IPPC Experts Group in March 2008.

Following agreement to the sectors and Member States, a list of proposed installations was developed, along with an equal number in 'reserve', should any of the primary installations be found to be unsuitable.

In order to provide the basis for a robust and consistent approach to the assessment of individual installations, a 'data collection and reporting template' was developed, building upon similar templates used for similar previous studies[22]. The use of a template approach provides for standardisation across a range of permits/sectors with transparency and the ability to easily compare different case studies.

The template developed covers all of the questions that need to be addressed for the purposes of the study (Section 2.1). To streamline the processes of data collation, analysis and reporting, a single template/pro-forma has been developed to be used for data collection and data reporting for all installation assessments (as all focus on answering the same questions, albeit with a different focus for each of the tasks[23]). As such, the completed

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[21] Task 3 also includes a general sector evaluation as described later in this section.

[22] Assessment of the implementation by the Member States of the IPPC Directive, report for European Commission, February 2007. Assessment of the implementation of the IPPC Directive in the UK, report for Department for Environment, Food and Rural Affairs, January 2008.

[23] Within the actual assessments, more focus is given to those aspects of the template that are most relevant for the installations concerned (e.g. related to the areas where complaints have been received for task 1 and the most significant environmental impacts for tasks 2 and 3).

templates were populated when collating and analysing information on the installations and then directly incorporated into the report. The content of the template was agreed with the Commission prior to its implementation.

Following agreement to the list of installations and the data collection and reporting template, the process for assessing installations was undertaken as shown in Figure 2.1.

Initial contact was established with the selected operators and associated competent authorities (through the national authorities). Following confirmation of suitability of the installations, information required for progression of the work was requested, including:

- A copy of the IPPC permit and subsequent variations (where applicable);
- A copy of the supporting technical report in support of the IPPC permit application, including additional information provided by the operator (where applicable);
- A copy of the completed permit reporting forms that detail current emissions;
- A copy of historical emissions data from release points within the installation (if available); and
- A copy of the IPPC permit supporting decision documentation (if available)[24].

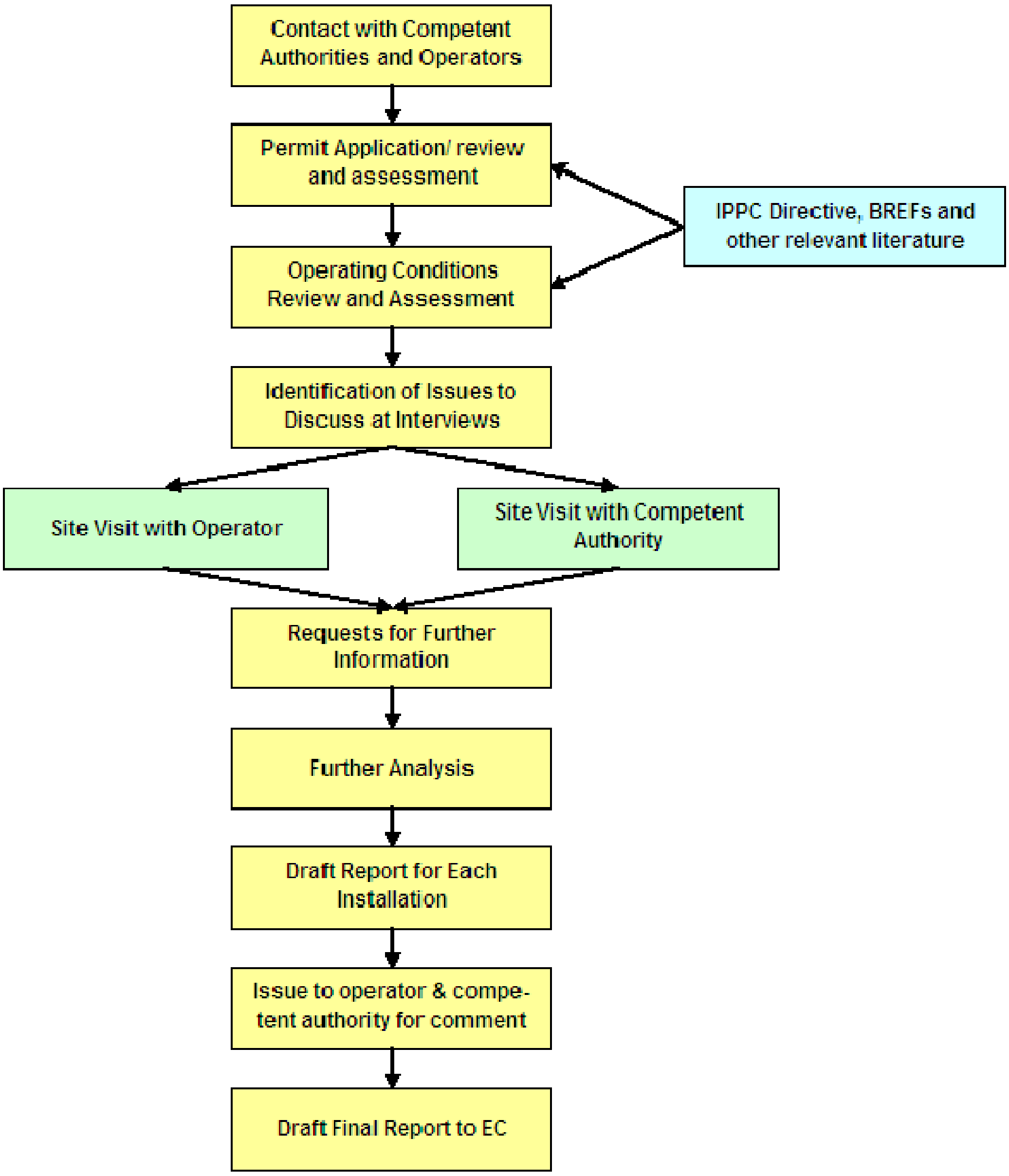
To facilitate this task, a letter of introduction was provided by the Commission to authorise undertakings on this project and encourage operating companies to participate in the study, by stressing the wider benefits of participation and addressing any particular concerns regarding the scope of work.

This first phase of the work involved a desk-based exercise using information gathered including permit applications, permits and supporting monitoring data. At this stage, there were usually a number of areas where clarification was required, particularly on the assessment of actual operation of the installations compared to permit conditions and BAT. In some cases, detailed information was not provided prior to the site visits.

Following the desk-based assessments, the findings of the initial investigations of each permit were consolidated within the agreed data collection and reporting template. A number of issues to discuss directly with the operators and competent authorities were then identified.

[24] Such documents, where available, provide a regulatory explanation as to the reasons behind the selection of the particular permit conditions. This type of document can be valuable as they present an audit trail of the process of decision making, which would be referred to, for example, if the competent authority was exposed to legal scrutiny. Such documentation is not available for all installations (and as such the level of detail possible in the assessments has varied amongst the case studies.)

Figure 2.1 Overview of approach to assessment of installations for tasks 2 and 3



Site visits and interviews were then undertaken with operators and competent authority representatives in order to confirm understanding of the implementation of the Directive for the installations concerned and to seek feedback on the process of implementation in order to identify opportunities for improvement of the IPPC Directive and areas where the Commission may help with implementation of the Directive (e.g. through enhanced information exchange or provision of guidance). It was stressed to the competent authorities and operators that this study was not a legal check on compliance and also that details of the installations concerned were to be kept confidential[25].

Site visits (or other forms of interview) improved the understanding following the desk based research and were essential for gaining perspectives on the permit or permit application to enable accurate completion of the data collection and reporting template.

The nature of site visits required was dependant on a number of factors, as highlighted in the completed data collection and reporting templates. These included identification of site specific issues and any absence of documented information. There was generally a large amount and a complex/diverse range of data in applications and permits, which were unlikely to be dealt with successfully in correspondence alone. Also there were in some cases several re-submissions and amendments to permits to consider and these were best reviewed in conjunction with the organisations involved directly in the permitting process.

The final reporting stage following analysis comprised a single report for each installation (the completed template[26]) including any supporting analysis (for example, the indicative analysis of emission limit values against actual operational emissions and BAT-AELs).

The completed draft data collection and reporting template was then sent to the competent authority and operator in order to clarify any areas of uncertainty and to provide a check on the accuracy of the information presented and validity of conclusions drawn regarding implementation.

Managing the **level of detail** included in the reports was recognised at an early stage as being vital in order that the project team, the Commission and other readers do not become overwhelmed by the quantity of information but also have sufficient supporting information to understand how the conclusions have been drawn (minimising the resource burden upon operators and competent authorities was also a key issue in gaining their support/participation). As such, the process for reporting was agreed to include

- The *results* of analysis in relation to the questions addressed for each installation;
- *Justifications* to support the results and conclusions drawn on specific issues related to each installations; but
- No extensive repetition of data/reports analysed in order to keep reports to a manageable level and
- An overall report with conclusions for each task and the overall conclusions building on the outcomes of the work.

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25 Mainly details that would allow individual installations or the employees of such installations to be identified or other information considered commercially confidential on a case-by-case basis.

26 The template is used both to capture relevant information and to present this in the overall report under the contract.

The completed templates do not include extensive repetition of information within the extensive documentation available for each installation. Instead, they are focused on providing answers to the key questions, with appropriate justifications and reference to the relevant documentation.

2.3 Selection of sectors, Member States and installations

2.3.1 Selection of Member States

Based on an approach proposed to and agreed with the Commission, the Member States for inclusion within Tasks 2 and 3 were selected taking into account the criteria below.

The desire to include a geographical balance of Member States

The countries selected reflect geographical variation of the Member States with a mix of countries from both Northern and Southern Europe as well as EU15 and newer Member States. This helps to identify any regional differences in implementation and some of the reasons for such variation.

Significance of overall sectoral emissions/discharges at a Member State level

Member States were selected partly on the basis of those countries for which certain installations result in significant emissions at a national and international level. The data was sourced from the EPER database, BREFs, data published by EMEP under the Convention on Long Range Transboundary Air Pollution (CLRTAP) and the IIASA and RAINS database.

Estimated number of IPPC processes

Countries with both large and small numbers of installations covered under the IPPC Directive provided an important insight into implementation issues at different scales. Data previously submitted by the Member States on implementation was used in the identification process.

Member States not previously covered

It was important to include some Member States within this study that were not covered in the previous study for DG Environment on implementation. However, it was also useful to include some Member States that were previously included, in order to examine issues and sectors that were not previously examined.

Consideration of different competent authorities involved in the process

Member States have various competent authorities responsible for implementation (information is listed for EU15 Member States from the analysis of Member States' first implementation reports on the IPPC Directive) and variation in the approaches taken and their consequent impacts on implementation was an important area of study.

Presence of national guidance for determining BAT

In some Member States, BAT guidance documents were issued in advance of the finalised European BREF document. This may have led to a different interpretation of BAT between those Member States that rely largely on their own country-specific guidance on BAT and those that take a stronger reliance on interpretation of the BREF. It was therefore interesting to compare countries that had set out national sector specific guidance, with those relying wholly on BREF documents.

Not all of the Member States chosen for inclusion necessarily fulfil all of the criteria

2.3.2 Sectors selected on the basis of a methodology developed by the contractor and the Commission (task 2)

The selection of the sectors covered within task 2 of the work was based on the following criteria.

Environmental impacts of the sectors, including emissions reported in EPER

Sectors were selected on the basis of those that result in significant emissions to air, discharges to water and discharges to land at a sectoral and Member State level. This data was sourced from the EPER database and other sources.

Sectors with clear conclusions in the BREFs

BREFs have now been finalised for all sectors and the revision process is underway for certain sectors. However, the strength of conclusions regarding what constitutes BAT varies amongst the BREFs and in some cases it is difficult to provide an actual measure of permit conditions and performance against the BAT conclusions in the BREFs. The sectors selected have BREFs with clear conclusions (for the main environmental issues to be addressed) against which implementation could be measured.

Sectors where previous studies indicated differences between permit conditions and BAT-AELs

Other studies for the Commission indicated that permit conditions are in many cases much less stringent than BREF BAT-AELs without clear justification.

Sectors not previously studied

Certain industrial sectors were not included in previous studies regarding implementation of the IPPC Directive. In order to gain a wider perspective of IPPC implementation sectors not previously studied have been included.

Coverage of range of IPPC processes

A range of other factors were taken into consideration in the sector selection process. These included factors such as the simplicity or complexity of specific processes, or the history of sectoral regulation. Both large and small installation types were covered.

The sectors selected each fulfilled some, though not necessarily all, of these criteria

The selection of sectors was an iterative task undertaken during the inception meeting. A shortlist of potential sectors was developed based on the criteria set out and these criteria were prioritised during discussions to facilitate the selection process by linking it with the overall strategic objectives for this study as presented by the Commission. The sectors chosen are presented in Table 2.1, together with commentary on the justification for inclusion.

Table 2.1 Assessment and selection of sectors

Sector	Justification for selection
Manufacture of iron & steel	This sector is represented by complex installations that comprise integrated steel works and separate process specific installations. Whilst previously studied, the Commission agreed that issues have previously been identified having regard to the application of BAT that warrant further study. The sectoral conclusions on BAT within the BREF documents are well defined and BAT-AELs are presented, making this a suitable candidate sector for this study. Given the complexity of the installations (e.g. integrated works), it was agreed that the analysis should focus upon sinter plant and associated blast furnaces. Whilst there are fewer numbers of installations than electric arc furnaces in some Member States, the overall emissions are more significant and there is more potential for variability. It was concluded that it would be too complex to look at all aspects so the focus should be upon these specific aspects (i.e. one permit per installation). There are generally clear conclusions on the main environmental impacts. For example, for sinter plants, these are dust, heavy metals, NOx, SOx, dioxins and energy efficiency. Installations have been selected based on the data in the EPER database, as well as other sources of information.
Surface treatment of metals	This sector is represented by often relatively simple installations and by companies that would fall into the SME definition. Although the relative potential impact of a single installation may be less than that of larger more complex ones, the cumulative impact across the EU can be significant and the level of controls implemented may vary. The BREF document on surface treatment of metals and plastic presents some clear sectoral conclusions on BAT, the sector has not previously been subject to other studies and therefore this presents a sound sector for inclusion in this study. It was agreed that the assessment would focus upon the manufacture of printed circuit boards as a specific example of this sector.

Sector	Justification for selection
Large combustion plant	This sector is comprised of large and potentially complex installations with high overall environmental impact, especially with regard to emissions to air. The sector has previously not been studied with regard to IPPC implementation but has been studied in other aspects (such as streamlining and in reference to the large combustion plants directive). The sectoral conclusions presented in the BREF document on BAT are clear and the Commission has also noted the relevance of the sector with regard to the incremental impact of IPPC given controls imposed through other Directives, including the LCP Directive and the Air Quality Daughter Directives. There have been notable issues raised in previous studies on application of BAT-AELs within permit conditions that further supports the case for inclusion of this sector in this study. It was agreed that the assessment would focus on implementation for coal-fired power stations based on clear conclusions in BREFs and indications of significant differences between BAT as set out in the BREFs and actual performance/permit ELVs. The main environmental effects relate to efficiency, emissions to air and water (BAT-AELs are set out), combustion residues/by-products, and noise. Installations were selected on the basis of EPER, and other emission inventories.
Manufacture of nitric acid	The environmental impact of emissions to air from this sector (notably the emissions of N_2O) creates a strong case for inclusion. In addition certain BAT-AELs may not have been adequately transposed into permits covering these installations despite the clear sectoral conclusions on BAT for this sector. As a sector not previously studied, its inclusion is considered to be adequately warranted based on the selection criteria. The main environmental impacts relate to N_2O and NOx emissions. There are clear BAT conclusions for emissions of these pollutants, as well as on common BAT, storage and recoverable energy. Installations have been selected on the basis of data from EPER based on a proxy pollutant (N2O) and other information available to the consultants.
Manufacture of fertilisers	The environmental impact of multi-media emissions from this sector (notably the emissions of Ammonia, NO_x and HF) creates a strong case for inclusion as a sub-sector of inorganic chemicals manufacture. There are clear sectoral conclusions on BAT for this sector and as a sector not previously studied, its inclusion is considered to be adequately warranted based on the selection criteria. It was agreed that the sub-sector to be selected should be NPK/CN fertiliser production on the basis that the BREF includes BAT-AELs against which implementation can be measured (NOx, HF, ammonia, dust, HCl). The main environmental effects for NPK/CN fertiliser manufacture are: NOx emissions, particulates, fluoride, ammonia and HCl as well as energy and water use.

2.3.3 Mineral oil and gas refineries (task 3)

The mineral oil and gas refineries sector was chosen for study to provide a general sectoral evaluation. It was recognised that mineral oil and gas refineries can have significant environmental impacts and a sector-wide evaluation of implementation of the Directive was intended to provide a good basis for identifying both the benefits and problems that exist in the implementation of the current legislation, particularly with regard to the clear BREF conclusions for this sector.

The Member States for the refinery case studies were selected based on discussions with the European Commission at the start of the project. The basis for selecting individual installations is outlined below.

2.3.4 Selected installations

The selection of specific installations for investigation was made by the project team, in discussion with the Commission.

In relation to specific installations, the factors set out in Table 2.2 were taken into account in selecting installations for Task 2.

Table 2.2 Criteria for selection of installations for task 2

Criterion	Details
Availability of a permit	Based on discussions with the Member State authorities, installations were selected on the basis that they had a permit in place (either issued or reconsidered in accordance with the IPPC Directive).
Significance of emissions/discharges within a sector/Member State	Within the chosen sectors/Member States, permits were selected on the basis of those installations that resulted in significant emissions to air, discharges to water and discharges to land at a sectoral and Member State level (notwithstanding the need to also consider smaller installations). These data were largely sourced from the EPER database.
Location of installation	For large Member States, it was considered appropriate, in some cases at least, to focus on those installations within a reasonable distance of each other in order to minimise the environmental impacts of travel and to allow that the proposed number of site visits and face-to-face interviews to take place within the planned time for site visits.

The criteria for selection of installations for Task 3 are set out in Table 2.3. In addition, the criteria applied for the Task 2 installations were also taken into account (specifically availability of a permit and location of installations).

Table 2.3 Criteria for selection of installations for task 3

Criterion	Details
Installations with various ownership	A large number of installations in the selected Member States belong to the same (multinational) company, while other companies only operate a single installation. Selection of installations provided a balance between individual installations and installations owned by multinational companies, whilst avoiding the selection of multiple installations belonging to one multinational company.
Installations of various complexity	The Nelson complexity index of installations in the selected Member States (see below) varies from 1 to 14. Selection of installations covered installations with capacities in the low, middle and high ends of this range.
Balance between large and small refineries	Nameplate capacity (expressed as crude distillation capacity) of installations in the selected Member States varies from about 500,000 tonnes/year to about 20,000,000 tonnes/year. Selection of installations covered installations with capacities in the low, middle and high ends of this range.

Criterion	Details
Balance between installations having high and low *overall* emissions	Total emissions of some key pollutants to air and water of installations in the selected Member States (see below) varies as follows (based on 2004 EPER data): • SO_2 to air: 177 – 27,000 tonnes/year • NO_x to air: 115 – 6,830 tonnes/year • NMVOC to air: 114 – 7,120 tonnes/year • PM10 to air: 51 – 460 tonnes/year • TOC to water: 0.7 – 414 tonnes/year • Total N to water: 7.6 – 432 tonnes/year Selection of installations covered installations with emissions in the low, middle and high ends of these ranges (within the limits of the total number of permits to be included).
Balance between installations having high and low *specific* emissions	Specific emissions of some key pollutants to air and water of installations in the selected Member States varies as follows (based on 2004 EPER data and nameplate crude distillation capacity): • SO_2 to air: 87 – 3,480 kg/ktonne • NO_x to air: 34 - 934 kg/ktonne • NMVOC to air: 28 - 732 kg/ktonne • PM10 to air: 4 - 73 kg/ktonne • TOC to water: 0.8 – 62 kg/ktonne • Total N to water: 0.6 – 72 kg/ktonne Selection of installations covered installations with specific emissions in the low, middle and high ends of these ranges (within the limits of the total number of permits to be included).

Based on the above criteria, the installations were selected and agreed with the Commission (including a main list and an equal number in reserve).

Following agreement to this list, discussions were held with Member States' national representatives, competent authorities and operators in order to confirm the suitability of the installations. This led to some installations being identified as unsuitable (e.g. due to non-availability of a permit or disruptions at the installation during the course of the study). As such, a number of the reserve installations were selected and, in addition, a small number of further installations were identified where a suitable permitted installation within the sector and Member State originally proposed could not be identified.

An overview of the selection of installations within specific sectors and Member States is provided in the table below.

Table 2.4 Numbers of installations in each sector and Member State for tasks 2 and 3

	Belgium	Czech Republic	France	Germany	Greece	Italy	Nether-lands	Poland	Slovakia	Spain	UK	Total
Surface treatment of metals and plastic (Printed Circuit Board manufacture)						1					1	**2**
Combustion installations (coal-fired power plants)					1	1	1	1	1	1	1	**7**
Iron and steel production (sinter plants & associated blast furnaces)						1	1		1	1		**4**
Production of basic inorganic chemicals (nitric acid manufacture)						1	1			1		**3**
Fertiliser manufacture (NPK/CN)						1	1		1	1		**4**
Mineral oil and gas refineries	1	1	1	1	2	*	1	1	1	1	1	**11**
Total	**1**	**1**	**1**	**1**	**3**	**5**	**5**	**2**	**4**	**5**	**3**	**31**

* Note that this installation was originally included but was not assessed because the permit was not issued within the timescales of this project.

2.4 General sector evaluation for refineries (task 3)

The assessment of individual permits feeds into the general conclusions on the review of implementation and the general sector evaluation for the refineries sector. The combination of the results of the assessment of individual installations, previous studies (such as the PDC report) and the results of a general sector evaluation allow conclusions to be drawn on the overall level of implementation of the IPPC Directive in the mineral oil and gas refineries sector in Europe.

In addition to the assessment of individual permits, the general sector evaluation included:

- A literature review. Besides the refinery BREF and the PDC study from 2004, the literature search included information sources regarding IPPC implementation, implemented measures and emissions from the EU refinery sector. Relevant documents included:
  - Studies undertaken within the framework of the implementation and the review of the IPPC Directive;
  - Studies undertaken within the framework of the LCP Directive;
  - Studies undertaken at a Member State level;
  - Environmental reports and other published information from companies operating refineries throughout the EU (some operating individual refineries and others operating several EU refineries).

- A workshop (held in July 2008) brought together experts from industry, authorities and other relevant bodies with practical experience of implementing IPPC in the mineral oil and gas refineries sector. The overall aim of the workshop was to share knowledge, invite discussion and identify further sources of information on issues of implementation of the IPPC Directive in this sector and

- A thorough assessment of the EPER data. The EPER database provides data on emissions to air and water from refineries in the EU15 and Hungary for 2001 and for the whole EU27 for 2004. It also provides information on the identity of the facility responsible for these emissions and on how these data have been obtained (measurement, calculation, estimation). These data were supplemented by information on complexity, capacity and utilisation factor to calculate specific emissions for all EU refineries for selected pollutants to air and water and allow influencing factors such as refinery complexity and methodology used to obtain the emission data to be taken into account. These specific emissions were then compared with the BAT levels in the refinery BREF, leading to a first conclusion regarding meeting the BAT levels for some pollutants to air and water.

3. Task two findings – Installations selected on the basis of a methodology developed by the consultants and Commission

3.1 Overview

This report provides details of the assessments undertaken for selected case study installations assessed under Task 2 of the study.

For each sector, **a summary of** the results of the analysis is provided in the following sections. The more detailed assessment templates are included in the appendices to this report.

In each of the following sections, the following structure is adopted:

- A *brief* introduction to the sector, including a background to the sector, key environmental issues, best available techniques and emission levels associated with BAT for the sector;
- A summary of the results of the assessment for each installation, focusing on key elements of the issues covered in the detailed assessment and
- A brief summary of the results for the installations covered in each sector[27].

The appendices to this report provide details of the completed templates for each of the installations. The templates also include references to the relevant documents used in the assessments (such as permits, permit applications, decision documents and emissions monitoring data).

The sections and tables below provide a summary, for each of the installations assessed, of the main findings in relation to:

- Procedures used and conditions set for the selected permits and
- Assessment of the actual installation operations when compared to permit conditions and to BAT.

Where possible, the information included in these summary assessments has been used to draw quantitative conclusions on the implementation of the IPPC Directive for the installations and sectors covered.

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27 Whilst the results cannot be considered as representative of the sector as a whole (given the limited number of installations), they do indicate certain issues with implementation associated with particular activities.

Table 3.1 Summary of installations included for Task 2

Sector	Member State	Installation ref (Note 1)
Surface treatment of metals and plastic (printed circuit board manufacture)	Italy	02/IT/18
	UK	02/UK/25
Combustion installations (coal-fired power plants)	Greece	02/EL/12
	Italy	02/IT/22 (Note 2)
	Netherlands	02/NL/14
	Poland	02/PL/30
	Slovakia	02/SK/15
	Spain	02/ES/33
Iron and steel production (sinter plants and associated blast furnaces)	Italy	02/IT/29
	Netherlands	02/NL/02
	Slovakia	02/SK/03
	Spain	02/ES/31
Production of basic inorganic chemicals (nitric acid manufacture)	Italy	02/IT/09
	Netherlands	02/NL/28
	Spain	02/ES/32
Fertiliser manufacture (NPK/CN)	Italy	02/IT/23
	Netherlands	02/NL/24
	Slovakia	02/SK/07
	Spain	02/ES/08

Notes:

1) Installation reference relates to task number, Member State and installation number for the task concerned. Thus 02/IT/18 is an installation under Task 2 of the study, it is located in Italy and is the 18th installation selected for Task 2 (the installation number may be more than the 20 included in this task because the total numbers include installations that were initially selected and then found not to be suitable, leading to the selection of reserve installations).

2) Installation was not yet operational at the time of assessment (new/replacement installation).

3.2 Surface treatment of metals and plastic (printed circuit board manufacture)

3.2.1 Background to the sector

Printed circuit boards (PCBs) are a manufacturing sub-sector of the surface treatment industry, where intricate electronic circuits are manufactured using metals on the surface of plastics. PCBs have particularly complex production sequences that may comprise over 60 operations. All activities are carried out using jig equipment (racks), barrel or coil operations.

The 2006 BREF on large volume inorganic provides the following information on the sector:

- The world market for PCBs in 2002 was $31.6 billion US (€33.4 billion in 2002 prices) and the European share of the world market in 2002 was 18.0 %.
- In 2002, total PCB production in Europe was €3.4 billion and the sector employed 29,000 people at 434 plants (note that not all of the plants are covered by the IPPC Directive).
- In 1999 there were 612 European PCB manufacturers. This number had reduced to 434 by 2002, with more than 80% of these being small and medium sized enterprises (SMEs).
- In Europe, there has been a trend towards a greater share of high-tech PCB production (higher specification products).

PCBs are electronic circuits with thin layers of tracking printed onto thin, nonconductive layers. Components such as resistors, capacitors, semi-conductors, mounts for processing chips and memory chips, are added in subsequent operations

3.2.2 Key environmental issues and BAT

The main environmental impacts of PCB manufacture relate to:

- Energy and water consumption.
- Consumption of raw materials and emissions to water.
- The BREF on surface treatment of metals and plastics (2006) does not indicate air emissions to be a primary environmental impact; however point source and fugitive emissions of volatile organic compounds (VOCs), entrained metal compounds and ammonia may have a localised environmental impact[28].

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[28] As such, the BREF on surface treatment using solvents is also of relevance for this sector.

- Wastes, notably hazardous wastes containing chemicals and/or metal compounds, are generated in the process of PCB manufacture. The particular wastes that can result in environmental impacts are metal-containing sludges and spent process solutions.

BAT that may be applied includes maximising recovery of metals such as copper through process optimisation, the recycling of etchant solution to reduce volumes of alkali waste, stripping of the dry resist and etch and final treatment to recover metals in the residues. Liquid wastes should receive oil/grease separation, centrifuge for solids reduction, nitrite, chromate and precipitation treatments to remove metals, nitrogen and sulphides. Final liquid effluent discharges should receive treatment using one or more of the following techniques: sedimentation, simple filtration, flotation and/or zero discharge techniques such as ultra filtration, membrane filtration and thermal or infra-red evaporation.

Table 3.2 Generic and process-specific BAT from the BREF on Surface Treatment of Metals and Plastics

Element	BAT
Generic BAT	Implement an effective environmental management system and minimise the effect of re-work through optimising processes, quality control and process re-evaluation measures; Benchmark the installation performance including utilities (water, energy), raw material usage, emission levels and consumption/production ratios; Minimise energy usage through effective design and implementation of energy efficient measures such as minimising heating loss and seeking heat recovery; Use open loop but not once-through cooling systems to prevent legionella and minimise water consumption through monitoring and optimising water recovery systems, reducing drag-in and minimising drag-out of water-based solutions, use multi-stage rinsing; Prevent, reduce, recycle and recover solid wastes through reducing materials losses and optimising consumption efficiency as per the BREF on STM (pp. 399-402); Achieve concentrations of pollutants in discharged waste waters that are in line with those associated emission levels summarised in 5.2 on page 403 of the BREF on STM; Achieve concentrations of pollutants in air emissions that are in line with the ranges typically achievable as presented in the BREF on STM (Table 5.4) pp 407.
PCB-specific BAT	**Rinsing**: When rinsing between steps, use squeeze (wiper) rollers to reduce drag-out, sprays and multiple rinse techniques. **Manufacturing the inner layers**: Use techniques with low environmental impact, such as alternative techniques to oxide bonding. **Dry resists**: When developing dry resist, reduce drag-out by rinsing with fresh developer solution, optimise the spraying of developer, control the concentrations of the developer solution, separate the developed resist from the effluent, such as by ultrafiltration. **Etching**: Use the drag-out and multiple rinse techniques, feed back the first rinse into the etching solution For acid etching, monitor the concentration of acid and hydrogen peroxide regularly and maintain an optimum concentration. For alkali etching, monitor the level of etchant and copper regularly and maintain an optimum concentration. For ammonia etching, regenerate the etching solution and recover the copper. **Resist stripping**: Separate the resist from the effluent by filtration, centrifuge or ultrafiltration according to the size of the flow. **Stripping the etch (tin) resist**: Collect rinsing waters and concentrate separately. Precipitate the tin-rich sludge and send for external recovery and dispose of spent solutions in an environmentally sensitive manner, using suitable techniques to ensure maximum recovery and treatment prior to disposal. **Air emissions (VOC)**: Reduce the emission of volatile compounds from application of the solder mask by using high solid, low VOC resins.

Monitoring of all emissions to air, water and land (potentially as part of an integrated environmental management system with trending of data to set annual objectives and targets) is considered to be BAT for the manufacture of PCBs.

3.2.3 Main emissions and levels associated with BAT

Sources of information

Information on the main emissions and levels associated with BAT have been taken from the BREF on surface treatment of metals and plastics (August 2006) and the BREF on surface treatment using organic solvents (August 2007).

Emissions to air:

Air emissions that may be locally important are ammonia (from copper etching in PCB manufacture and electroless plating) and particulates (as a combination of abrasives and abraded substrate is generated by the mechanical preparation of components). Solvents are used in some degreasing operations and often the PCB process may involve a coating activity for which solvents are used; therefore emissions of volatile organic compounds (VOCs) may be significant. Combustion gases generated by heat boilers include CO, NO_x and particulates; where boilers are used, it is BAT to utilise natural gas-firing and low NO_x burners.

Table 3.3 BAT and associated emission levels (AELs) from BREF on surface treatment of metals and plastics

Pollutant	BAT-Associated Emission Level
VOCs	No comparable figure in STM BREF. For coating activities, the Surface Treatment using Organic Solvents BREF indicates a range of 20-100 mg/m^3 can be achieved using 2 or 3-bed thermal oxidisers. The actual concentration will depend on the abatement configuration, energy consumption and VOC concentrations in the primary gas stream.
Particulates	Achieve a particulate concentration of 5-30 mg/m^3 using particulate treatments such as: Wet scrubber; Cyclone; Fabric filter
NO_x	Achieve a nitrogen oxides concentration of 5-500 mg/m^3 using a combination of: combustion conditions optimisation, effective maintenance, low-NO_x burners, wet scrubbers (alkali for best performance) or adsorption towers.
Ammonia	BREF document concludes no data available from PCB installations to set a BAT-AEL.
HCl	Achieve a concentration of 0.3 - 30 mg/m^3 using a combination of non-air agitation, low temperature processes, non-cyanide processes and/or an alkali scrubber.

Emission levels are indicative emission ranges. Averaging periods are not specified.

Emissions to water:

The main emissions to water are from cooling systems and water used for rinsing. Emissions to water are of primary concern where discharges are made directly to surface water. Pollutants of note (from cooling systems and/or rising water) are heavy metals (which are used as soluble salts), cyanides and surfactants, which may have low biodegradability and accumulative effects in surface waters, e.g. nonylphenol ethoxylate (NPE) and perfluorooctane sulphonate (PFOS). Effluent treatment of cyanides with hypochlorite may result in the production of Adsorbable Organic Halides (AOX). Complexing agents (including cyanides and ethylenediaminetetraacetic acid (EDTA)) can interfere with the removal of metals in wastewater treatment or remobilise metals in the aquatic environment. Other ions, such as chlorides, sulphates, phosphates, nitrates and anions containing boron may be significant at a local level if there are direct discharges to surface water.

Table 3.4 BAT and associated emission levels (AELs) from BREF on surface treatment of metals and plastics

Pollutant	BAT-Associated Emission Level
Silver (Ag)	0.1 - 0.5 mg/l
Aluminium (Al)	1 - 10 mg/l *
Cadmium (Cd)	0.1 - 0.2 mg/l
Calcium nitrate	0.01 - 0.2 mg/l
Chromium VI (Cr VI)	0.1 - 0.2 mg/l
Chromium (total)	0.1 - 2.0 mg/l
Fluorine (F)	10 - 20 mg/l *
Iron (Fe)	0.1 - 5 mg/l *
Nickel (Ni)	0.2 - 2.0 mg/l
Phosphate (as P)	0.5 - 1.0 mg/l *
Lead (Pb)	0.05 - 0.5 mg/l
Tin (Sn)	0.2 - 2.0 mg/l
Zinc (Zn)	0.2 - 2.0 mg/l
Chemical Oxygen Demand (COD)	100 - 500 mg/l *
Total hydrocarbons	1 - 5 mg/l *
AOX	0.1 - 0.5 mg/l *
Suspended Solids	5 - 30 mg/l *

BAT-AELs using the common aqueous treatment techniques as presented in Table 4.13 of the BREF on Surface Treatment of Metals and Plastics (pp 301-304). BAT-AELs are for daily composites unfiltered prior to analysis and taken after treatment and before any kind of dilution, such as by cooling water, other process waters or receiving waters

* Additional determinants applicable for emissions to surface waters as these may have a more significant environmental impact on aquatic ecosystems when discharged directly as opposed to discharges treated through a common biological (aerobic/anaerobic) wastewater treatment works.

3.2.4 Case study 1 – Italy

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/IT/18. The information in this table is based on the detailed assessment for this installation in Appendix A1. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation manufactures printed circuit boards and is a listed activity as defined with Annex 1 of the IPPC Directive 2.6 “Installations for surface treatment of metals and plastics using an electrolytic or chemical process where the volume of the treatment Vats exceeds 30m^3”. Currently the activities within the installation include the design and construction of the circuit board, prior to it being sent to another factory for completion. The main operational steps within the installation include: ▪ Design, drawing and transposition on film (including development and fixing) of the circuits to be produced ▪ Cutting the circuit board to size ▪ Chemical activation and rinsing ▪ Lamination ▪ Photoprinting ▪ Chemical etching (acid (HCl) and alkali (hydrogen peroxide)) The installation has a waste water treatment plant (WWTP) and abatement equipment for emissions to air from the etching process.
Type of permit / issue date	The installation was previously permitted separately for discharges to air and to water. In 2004 the installation originally applied for an IPPC permit. However this application was withdrawn when the national legislation implementing the IPPC Directive was reissued. After incorporation of variations, consultation and determination the permit was issued in December 2007.
Basis of BAT determination	The operator used the Italian translation of the BREF document to evaluate BAT. In relation to emissions to water and to sewer, ELVs are set out in national legislation and as such constitute GBRs. This legislation is referenced within the permit.
Permit application	
Requirements of Article 6	The Operator completed the template provided by the regional government to submit the application for a permit. As a result, the application addressed all of the requirements of Article 6. However, the competent authority deemed information in some instances to be insufficient and as a result the operator was sent formal requests to provide more information. Specifically the requests required more detailed information to be supplied on emissions to air, a description of the wastewater treatment process and on waste categorisation.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The legal framework and summary of key communications during the determination period is included in the introduction of the permit. The permit includes a description of the air, water and waste emissions from each phase of the production process and also provides details on the nature of the waste produced as well as details on the wastewater treatment process. This information is as described within the application and forms part of the decision document of the competent authority. The permit includes a detailed monitoring plan and also a section outlining the limits and prescriptions which apply to the installation.

	The permit also contains conditions related to pollution prevention measures, waste avoidance, recovery and disposal, energy efficiency and accident provision. Furthermore the permit indicates that no plans exist to close to installation before 2050 and consequently no specific details are provided on site closure measures.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** In the absence of suitable monitored data, no ELVs have been set at present for the emissions to air. The operator has been required, through the permit, to conduct air monitoring. The competent authority is currently reviewing the operator's monitoring report and is proposing to use these results, along with national legislation and BAT-AELS defined within the BREF guidance, to determine the ELVs to air that will apply to this installation. This review process will generate: prescriptive requirements, ELVs, details of which emissions are to be monitored on an annual basis and a possible requirement to provide abatement of emissions. **Water:** The ELVs for discharges to water and sewer and which apply to this installation are as defined within national legislation and are summarised in Table A2.1 below. **Land:** No ELVs have been set for emissions to land. **Protection of soil and groundwater** The permit does not include ELVs for discharges to land but does include pollution prevention conditions to seek to ensure adequate environmental protection of soils and groundwater. **Waste** The permit does not include ELVs for waste but does include conditions to seek to ensure adequate environmental protection from waste management, storage, recovery and disposal activities. **Transboundary considerations** Transboundary pollution in the form of acid rain may occur as a result of acid emissions to the atmosphere. However, due to the small scale of installation and distance from the country boundary, transboundary considerations have not been taken into consideration in the permit. **Further equivalent technical parameters/measures** The permit states the need to comply with local noise limits in force, as reported in the noise levels zoning document prepared by the communal authorities.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** ELVs have not yet been set in relation to emissions to air (see above) and cannot therefore be considered as based on BAT. The permit sets out requirements for the operator to respect the limits set out in national legislation (Table 3, Appendix 5 Part III of D. Legs 152/06) for emissions from the installation to public sewer. The relevant ELVs and their comparison against BAT-AELs are outlined in the table below and in the full assessment report in Appendix A1. The limits are all within the BAT-AEL range except for total cyanide where the ELV is set higher than the BAT-AELs provided in the BREF.
	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? There is no evidence of consideration of specific technical characteristics, geographic location or local environmental conditions. **Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?** None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** None observed.
Use of relevant BREF documents in setting permit	The competent authority has taken into consideration the Italian translation of the BREF document for the Surface Treatment of Metals as well as national legislation in relation to emissions to water. There is no

conditions?	country-specific guidance in place for this industrial sector. The permit states that the techniques currently applied on site are: ▪ a procedure for minimisation of production leftovers (off-cuts) ▪ controls relating to water and energy consumption ▪ the technical office routinely carries out production optimisation and control ▪ acids and alkali are stored separately ▪ oxidisers and combustibles are stored separately ▪ re-supply of liquid raw materials (when not in drums) is carried out through tight piping ▪ solution mixing is carried out by means of very low pressure air ▪ power factor correction is to be carried out whenever the threshold of 0.90 is reached for cos Φ ▪ minimisation of the distance between electrodes and rectifiers in order to reduce voltage ▪ regular controls and cleaning of rectifiers ▪ wash waters are to be recovered and re-used in the process ▪ water drag-out is minimised and wash water is recovered ▪ chemical laboratory controls the correct dosage of reactants in the vats These techniques are all defined as BAT within Chapter 5 (p389) of the Surface Treatment of Metals and Plastic BREF document.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit includes a control and monitoring plan, which sets out the parameters to be measured and the frequency for measurement. The control and monitoring plan includes details on monitoring requirements in relation to: ▪ Waste produced ▪ Gas use ▪ Wastewater emissions ▪ Wastewater treatment (pH checks) ▪ Noise ▪ Maintenance of critical machinery ▪ Checking of storage areas ▪ Performance indicators (energy use, water use) The control and monitoring plan does not include information on sampling/measurement time. The competent authority is currently reviewing an air monitoring report from the installation. The outcome of this review will be the setting of ELVs and appropriate monitoring frequencies for emissions to air. No measurement methodology is included in the control and monitoring plan in relation to emissions to water, however reference is made in the permit **Are the monitoring requirements sufficiently detailed?** With exception of emissions to water, the monitoring requirements within the permit are detailed with regards to information on parameters, frequency and method; however there is no information provided relating to sampling/measurement time. The permit does not include any information in relation to monitoring emissions to water. Emissions to water are regulated through national legislation D.Legs 152/06 and the permit makes reference to this. **Do the monitoring requirements take into account the details contained within the BREF documents?** In the absence of ELVs for emissions to air, no monitoring has currently been proposed for air emission points despite the BREF stressing the need for monitoring and measurement. In line with BAT, as defined within the Surface Treatment of Metals BREF document, the installation monitors performance indicators for benchmarking purposes. The permit sets out requirements for daily monitoring of the pH on solutions and also in the WWTP, while the BREF document specifies BAT as being continuous monitoring. **Does the permit include information on duration in relation to monitoring requirements?** The permit includes information on frequency but no information on the actual sampling times to be applied.

Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	The permit includes conditions relating to responding to emergency situations such as spillages.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** The ELVs for discharges to sewer from this installation are based on national legislation. Reference to this legislation is made within the permit.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** There is no direct discharge from this installation to a watercourse therefore no EQSs apply in relation to water emissions. For emissions to air, ELVs have still to be set following review of the monitoring data submitted by the operator. The competent authority reported that no EQSs have been identified that require stricter conditions for emissions from this installation.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	As set out within the permit, the conditions will be reviewed within 5 years of the permit issue date. This is in line with national legislation. As the permit was only issued in December 2007 it has not yet been reconsidered.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Under national legislation the operator was required to publish an advertisement in a local newspaper inviting public consultation. During a 30 day period after this advert was placed, the application was available to view at the provincial government offices. The application, decision document and permit are all available to view on the public register. **Are monitoring records made available to the public?** Information on monitoring is made available to the public on request.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The following monitoring was completed by the operator in 2007, prior to the permit being issued: ▪ Annual raw material consumption ▪ Annual consumption of water and energy ▪ Four-monthly monitoring of discharges from the WWTP ▪ Performance indicators (Water consumption m^3/m^2 of production; electricity MW/m^2 production)
Operator's compliance with monitoring conditions	The monitoring outlined above has been incorporated into the monitoring plan within the permit. In addition, the permit sets out requirements for the operator to submit monitoring data for air emission points 60 days from permit issue. This monitoring has been conducted by external consultants and has been submitted to the competent authority and has been judged to be in line with permit requirements. As indicated above, this monitoring data is to be used by the competent authority in setting permit conditions (for ELVs for air emissions). While the monitoring data had been submitted to the competent authority in line with permit requirements, a number of clarifications were required prior to including ELVs for emissions to air within the permit.

Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	The operator provided an annual monitoring report for 2007. This report includes monitoring data for emissions to water, conducted prior to the permit being issued. This shows that emissions to water from the installation were in line with the BAT-AELs prior to permit issue.
Current emissions of key pollutants	This information is provided within the table below.
Assessment of Installation performance against BAT	**Current performance:** Based on the emission results included within the table below, the installation performs within most of the BAT-AEL ranges. BAT-AELs for VOC emissions are not included in the table below as there is no specific ELV in the Surface Treatment of Metals or Surface Treatment with Solvents BREF documents applicable to the processes concerned. However, the highest measured value, as shown in the table below is around 7 mg/m^3 which is below the ELVs set in the Solvent Emissions Directive, 1999/13/EC (the lowest ELV in the Directive is 20 mg/m^3 for the most hazardous VOCs and 75 mg/m^3 for other VOCs for surface cleaning processes).
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	As documented within the permit and application, this site is not at present deemed to present issues in terms of operative life. There are no plans to close the facility any earlier than 2050. The General Prescriptions section of the permit sets out requirements for the site to be restored at the end of the operative plant life in accordance with the statutory requirements regarding environmental remediation. This section of the permit also sets out a need for measures to be taken in case of accidental pollution events during the operational life of the plant.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** Once a year ARPA (regional agency for protection of the environment) will conduct an annual site inspection. In addition they will review the annual report submitted by the operator in line with permit requirements. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** As the permit was only issued in December 2007 no site inspections have been undertaken. The first annual report is due to be issued by the operator in May 2009. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The Operator currently has a certified ISO9000 quality management system (QMS) in place. Through this system there are procedures in place for auditing; these audit procedures are applied by the operator to environment, health and safety issues. Each area of the installation is audited twice a year for environmental issues. An audit report is maintained and any non-conformance and associated corrective actions are documented. The operator continuously monitors process parameters. This would help the operator to identify a potential breach in an ELV and also other environmental issues. **Procedures used or action taken by the operator in the event of non-compliance** A non-compliance report is written and corrective actions are identified. This is approved and signed off by senior management. In the event of an emergency situation, the operator would notify the competent authority as required by the permit. The General Prescription section of the permit states that, in case the self-monitoring reveals an anomaly, the operator will have to immediately notify the competent authority and ARPA, without waiting for the yearly report to be prepared.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** No on-site inspections have been carried out in the last 12 months (as of July 2008); however the permit was only issued in December 2007. The frequency of inspection as defined within the permit (annual) is deemed by the competent authority to be typical for this type and size of installation.

Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Results of monitoring are held on the public register and are available upon request.
Key observations from this case study assessment	

- This assessment has identified that the operator has generally implemented techniques in line with BAT as defined within the BREF document. In addition there is evidence that the BREF document and national legislation for emissions to water/sewer were taken into consideration by the competent authority in the writing of the permit.
- No ELVs have been set in relation to emissions to air. Based on the information provided by the competent authority, this was due partly to the lack of available information provided by the operator in relation to monitored emissions, and partly due to the pressure to ensure the permit was issued before the 31st October 2007 in line with the requirements of the IPPC Directive.
- A subsequent assessment of the monitoring data collected by the operator, following permit issue and provided as part of this study, suggests that emissions to air from the installation (based on that monitoring data) are all either within the BAT-AEL ranges and in some cases below the lower end of those ranges.
- In relation to the application for a permit, the operator provided information on the condition of the site to the competent authority. While this does provide details on the condition of the site as required by Article 6, its content is limited to the provision of a hydrogeology report.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air (Note 1)									
E07 (Development galvanic gilding)	Total dust Nickel Tin Acid mist VOC	0.44-0.55 mg/m^3 <0.03 mg/m^3 <0.03 mg/m^3 <0.857 mg/m^3 0.75-7.37 mg/m^3	N/A	<5-30 mg/m^3 <0.01-0.1 mg/m^3	N/A	YES YES	UNI EN 13284-1 M.U.723 M.U.723 UNI 10493 D.M. 25/8/00	Unknown (Note 2)	0°C, 1013 mbar
E10 (Laboratory, activation and soldering wave)	Acid mist	3.70-4.30 mg/m^3	N/A	-	N/A	N/A	D.M. 25/8/00	Unknown (Note 2)	0°C, 1013 mbar
E11 (edge of metallisation bath)	VOC	1.12-1.44 mg/m^3	N/A	-	N/A	N/A	UNI 13649	Unknown (Note 2)	0°C, 1013 mbar
E12 (hood above metallisation bath)	VOC Alkali mist	0.66-1.61 mg/m^3 0.35-0.48 mg/m^3	N/A	-	N/A	N/A	UNI 13649 Internal methodology for determining Na and K by means of CP-OES	Unknown (Note 2)	0°C, 1013 mbar
E13 (plates cleaning & laser drill)	Dust VOC HF	0.49-3.88 mg/m^3 0.80-1.76 mg/m^3 0.40-2.27 mg/m^3	N/A	<5-30 mg/m^3 <0.1-2 mg/m^3	N/A	YES NO	UNI13284-1 UNI13649 DM.25.08.00	Unknown (Note 2)	0°C, 1013 mbar
E14 (plate drilling)	VOC Dust	0.77-1.23 mg/m^3 0.42-1.29 mg/m^3	N/A	 <5-30 mg/m^3	N/A	YES	UNI13649 UNI 13284-1	Unknown (Note 2)	0°C, 1013 mbar

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
E18 (plates development & stripping)	Alkali mist	1,45-1,89 mg/m^3	N/A	-	N/A	N/A	Internal method for determining Na and K by means of ICP OES	Unknown (Note 2)	0°C, 1013 mbar
E20 (copper blackening baths)	Alkali mist	0.39-0.45 mg/m^3	N/A	-	N/A	N/A	Internal method for determining Na and K by means of ICP OES	Unknown (Note 2)	0°C, 1013 mbar
E21 (shaping and multilayer cutting)	Dust	1.32-1.44 mg/m^3	N/A	<5-30 mg/m^3	N/A	YES	UNI 13284-1	Unknown (Note 2)	0°C, 1013 mbar
E23 (ammonia etching)	Ammonia (NH_3)	4.22-4.66 mg/m^3	N/A	0.1-10 mg/m^3 (Note: Data Is from electroless nickel. No data for PCB.	N/A	YES	UNICHIM 632	Unknown (Note 2)	0°C, 1013 mbar
E24 (ovens & galvanic at ground floor)	VOC Acid mist	< 0.50 mg/m^3 0.35-0.52 mg/m^3	N/A	-	N/A	N/A	UNI 13649 D.M. 25/8/00	Unknown (Note 2)	0°C, 1013 mbar
E33 (dry film stripper)	Alkali mist	0.42-0.50 mg/m^3	N/A	-	N/A	N/A	Internal method for determining Na and K by means of ICP OES	Unknown (Note 2)	0°C, 1013 mbar
E38 (etching & galvanic)	Acid mist	1.58-12.14 mg/m^3	N/A	-	N/A	N/A	D.M. 25/8/00	Unknown (Note 2)	0°C, 1013 mbar
E40 (developers)	VOC	1.02-1.62 mg/m^3	N/A	-	N/A	N/A	UNI 13649	Unknown (Note 2)	0°C, 1013 mbar

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
E41 (dry film laminators)	Alkali mist	0.26-0.38 mg/m^3	N/A	-	N/A	N/A	Internal method for determining Na and K by means of ICP OES	Unknown (Note 2)	0°C, 1013 mbar
E42 (multilayer alignment)	Dust	1.15-1.32 mg/m^3	N/A	<5-30 mg/m^3	N/A	YES	UNI 13284-1	Unknown (Note 2)	0°C, 1013 mbar
E43 (hot air levelling)	Dust Lead HCl		N/A	<5-30 mg/m^3 <0.3-30 mg/m^3	N/A	N/A		Unknown (Note 2)	0°C, 1013 mbar
E44 (solder oven and serigraphy)	VOC	0.5-6.01 mg/m^3	N/A	-	N/A	N/A	UNI 13649	Unknown (Note 2)	0°C, 1013 mbar
E45 (solder development)	Alkali mist	1.40-1.95 mg/m^3	N/A	-	N/A	N/A	Internal method for determining Na and K by means of ICP OES	Unknown (Note 2)	0°C, 1013 mbar
Notes: Cells where a dash "-" is included indicate that no information is available on this aspect. 1) The permit reviewed for this assessment did not include ELVs for emissions to air (as described above). 2) The permit did not include ELVs for emissions to air (these were to be added later). The monitoring data reviewed for the purposes of this assessment did not include information on the averaging periods used. The BREF for surface treatment of metals does not include information on averaging periods in relation to emissions to air (the data presented in Table 5.4 of the BREF are "indicative emission ranges").									
Emissions to water									
S1 (discharge to public sewer)	pH	7.8	5.5-9.5	-	YES	N/A	-	Daily (Note 3)	-

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	Total suspended solids	23.2	≤200	-	YES	N/A	-	Daily (Note 3)	-
	BOD_5	27.3	≤250	-	YES	N/A	CNR-IRSA	Daily (Note 3)	-
	COD	134	≤500	-	YES	N/A	CNR-IRSA	Daily (Note 3)	-
	Lead	<0.005	≤0.3	0.05-0.5	YES	YES	CNR-IRSA	Daily (Note 3)	-
	Nickel	0.008	≤4	-	YES	N/A	CNR-IRSA	Daily (Note 3)	-
	Tin	<0.005		0.2-2	N/A	YES	CNR-IRSA	Daily (Note 3)	-
	Zinc	0.028	≤1.0	0.2-2.0	YES	YES	CNR-IRSA	Daily (Note 3)	-
	Copper	0.351	≤0.4	0.2-2.0	YES	YES	CNR-IRSA	Daily (Note 3)	-
	Total cyanide		≤1.0	0.01-0.2[4]	N/A	N/A	CNR-IRSA	Daily (Note 3)	-
	Total Phosphorous		≤10	-	N/A	N/A	CNR-IRSA	Daily (Note 3)	-
	Chloride	618	≤1200	-	YES	N/A	CNR-IRSA	Daily (Note 3)	-
	Sulphate	126	≤1000	-	YES	N/A	CNR-IRSA	Daily (Note 3)	-
	Total surfactants		≤4	-		N/A	CNR-IRSA	Daily (Note 3)	-
	NO_2	<0.05	≤0.6	-	YES	N/A	CNR-IRSA	Daily (Note 3)	-
	NH_4	13.1	≤30	-	YES	N/A	CNR-IRSA	Daily (Note 3)	-

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	NO_3	1.07	≤30	-	YES	N/A	CNR-IRSA	Daily (Note 3)	-

Notes:

3) Emissions monitoring data are based on daily averages which is in line with the conditions of the permit (which refers to General Binding Rules where the limit values are set out). The BREF on surface treatment of metals and plastic also indicates that the BAT-AELs are daily averages (p. 404).

4) Whilst no emissions have been measured for total cyanide, the permit emission limit value has been set at a level that would allow emissions that are higher than the relevant BAT-AEL.

Emissions to land

Notes: Not applicable.

3.2.5 Case study 2 – United Kingdom

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/UK/25. The information in this table is based on the detailed assessment for this installation in Appendix A2. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation manufactures printed circuit boards (PCBs) and is covered under Activity 2.6 of Annex I of the IPPC Directive “*installations for surface treatment of metals and plastic materials using an electrolytic or chemical process where the volume of the treatment vats exceeds 30m^3”*. The installation is an integrated manufacturing process, undertaking board etching and stripping, bonding, drilling, electroless plating, pattern plating, coating with solvents, cleaning and testing. The installation also includes VOC emission abatement equipment, effluent (waste water) treatment plant, ammonia scrubber and waste solvent distillation plant.
Type of permit / issue date	The permit was issued in April 2005 according to the timetable for permitting used in the UK. Prior to this, the coatings process undertaken by the installation was permitted as a "Part B" (national legislation for installations regulated for air emissions only). The IPPC permit issued runs concurrently with a wastewater “discharge consent” from the sewage undertaker (water utility company) issued in 2001. The wastewater consent – and in particular the limits set therein – has been assessed by the competent authority and the overall impact on the receiving sewage works (according to the Urban Wastewater Treatment Directive) evaluated. The conditions of the IPPC permit require the operator to meet the limits of the discharge consent.
Basis of BAT determination	The determination of BAT was made by an independent environmental consultant working on behalf of the competent authority. The determination was made using national guidance documents, rather than by direct reference to the BREF document on ‘Surface treatment of metals and plastics’. The key national guidance documents used were: ▪ Sector Guidance Note IPPC S2.07 on ‘Surface treatment of metals and plastics by electrolytic and chemical processes’[29] ▪ Process Guidance Note PGN 6/23(04) on ‘Coating of metals and plastics’ [30]
	These UK-specific guidance documents have been drafted by the competent authority in response to a regulatory requirement to adopt the information within the BREF document and set it within a national context. They contain similar types of information with most sources being drawn from the BREF; in particular the benchmark values are often a direct transposition of BAT-AELs as presented in the BREF. Many, but not all of the Sector Guidance Note benchmarks are commensurate with BAT-AELs.
Permit application	
Requirements of Article 6	An assessment of the operator’s application shows that it contained all the key elements required by Article 6 of the IPPC Directive. The checks made by the competent authority upon receipt of the application required only minor additional information to be supplied.

29 http://www.environment-agency.gov.uk/commondata/105385/ipps2.07_887513.pdf

30 http://www.defra.gov.uk/environment/ppc/localauth/pubs/guidance/notes/pgnotes/pdf/pg6-23.pdf

Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit contains most of the necessary conditions to ensure that the installation is operated in a manner that meets the requirements of Article 3. This includes conditions that require the operator to implement measures: to ensure energy efficiency; to stipulate raw materials that can be used in the process and their associated environmental fate should they change; to control waste storage and generation; to minimise the risk of accidents and incidents with environmental consequences and develop measures to reduce environmental impact in the event of an accident or non-normal operation. The main elements omitted from the permit were suitable conditions relating to the minimisation of waste and appropriate recovery and disposal of waste materials.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	Emissions are considered within Section 6 of the permit and are addressed in a systematic manner (air, water, land, etc.). **Air:** All air emission ELVs are set using benchmark values as presented in the UK Sector Guidance Note IPPC S2.07. ELVs have been set for the main air pollutants including VOCs (for both the PCB manufacturing and coatings processes), heavy metals, NO_x, particulates, CO and ammonia. The ELVs are listed in Table 1 below. In addition to the point-source ELV for VOCs, the permit also sets a fugitive solvent emission limit of 20% of total solvent input. The fugitive emissions have to be determined by the Operator in accordance with the method prescribed in Schedule B of the permit itself and is based on measurement and/or calculations. **Water:** No direct emissions to water (surface and groundwaters) are made from the installation and the permit requires that all surface drainage is routed to the foul sewer for treatment at a municipal Waste Water Treatment Works operated by the local water company. **Land:** No emissions to land are permitted by this permit. **Waste:** No ELVs are included in the permit related to the disposal of waste. Disposal of wastes from the installation is controlled by specific waste legislation such as the 'Duty of Care' Regulations 1991 and the recently introduced Environmental Permitting Regulations 2007[31] (updated regulations which also enact various EU legislation including the IPPC Directive). The permit contains conditions to control aspects associated with storage of waste to control the risks of pollution whilst in storage on site. **Protection of soil and groundwater:** Conditions require that all surface water drains are fitted with inflatable acid-resistant cut-off devices to reduce pollution potential and to protect the surface sewer system. As a back-up measure, all surface drains are routed to foul sewer. **Transboundary considerations:** No conditions are included within the permit on minimisation of transboundary pollution. The air dispersion modelling report, developed and submitted by the operator, has been assessed by the Competent Authority and no significant long-range environmental impacts were considered likely to occur as a result of the emissions from the installation. **Further equivalent technical parameters/measures:** No further equivalent technical parameters have been set in the permit as alternatives to emission limit values.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** From the assessment and comparison of permit conditions against the key requirements of the UK Sector Guidance Note, it is apparent that, in general, conditions are set based on BAT information that was available at the time of the permit determination (2004). The Operator has since conducted BAT studies based on new information and this has been submitted to the competent authority for consideration in future permit reviews. The assessment of emissions to air, water and land conducted by the operator and reviewed by the competent authority demonstrated that such emissions would have an insignificant impact on the surrounding environment. On this basis, the competent authority set permit ELVs for key emissions in line

31 The Environmental Permitting Regulations 2007 (SI 2007 No. 3538).

	with benchmark values from the UK Sector Guidance Note (SGN). This SGN was based upon the (then draft) surface treatment of metals and plastics BREF document. However, it is evident from a comparison between the UK Sector Guidance Note and the BREF on Surface Treatment of Metals and Plastics, published in 2006, that some of the BAT Associated Emission Levels (BAT-AELs) have changed since the publication of the draft BREF. Consequently some of the permit's ELVs are above the BAT-AEL ranges provided in the BREF. An example of the is the particulates ELV that is set at 50mg/m3 as opposed to the BAT-AEL range of <5-30 mg/m3. For emissions from the 'directly associated' coatings process (that does not in itself breach the IPPC threshold but is covered by IPPC but as a "Part B" activity under the UK's national legislation), the permit contains ELVs taken directly from the UK's Process Guidance Note 6/23(04) and, as such, no directly comparable BREF BAT-AEL exists for this process as these limits relate to the Solvent Emissions Directive. A comparison of the ELVs set for VOCs against the BAT-AELs contained within the BREF on Surface Treatment using Organic Solvents indicates that conditions have been set based on BAT for the following reasons. BAT is to: a. Minimise emissions at source – conditions require the operator to make a feasibility study and optimise the reduction of VOCs at source (which has been completed by the operator); b. Destruction of solvents in the gas stream – conditions require that the operator utilises thermal oxidation technologies to achieve a level of < 50 mg/m3 (BAT is in the range 20-100 mg/m3).
	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? The specific technical characteristics of the installation, its geographical location and local environmental conditions were considered in setting ELVs and technical parameters. As part of the application process, the operator completed an assessment of the significance of the environmental impact resulting from emissions made from the installation using the competent authority's methodology (H1 Environmental Assessment and Appraisal of BAT[32]): This approach uses a significance test of the impact of the emissions from the installation having regard to local environmental conditions (background pollutant concentrations) and geographical location (wind speed, direction and proximity of sensitive receptors). The local factors assessed as part of the determination included proximity to surrounding sensitive receptors (Special Areas of Conservation (SACs / Special Protection Areas (SPAs) / Air Quality Management (AQM) zones) and human habitation. The method uses a series of steps: ▪ the level of pollution contributed by the installation (process contribution) is assessed against short and long-term environmental air and water quality standards and human health exposure assessment limit values, including quality standards set at an EU level; ▪ the process contribution is added to the background concentration to provide a predicted environmental concentration; ▪ the output values are then compared to existing air and water quality standards (including EU limits) (long and short term) and a calculated value greater than 1% (for short term values) or greater than 10% (for long term values) requires further modelling work to be undertaken. The outputs of this assessment process are then used in the determination of relevant emission limit values or equivalent technical measures. In making the determination, the competent authority may take into account local air and/or water quality standards set at a national level although in this case study, there were no relevant limits that were considered at risk of being breached.
	Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)? None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** None observed.

32 http://www.environment-agency.gov.uk/business/1745440/444663/298441/horizontal/545377/

Use of relevant BREF documents in setting permit conditions?	**There was no direct use of the BREF on Surface Treatment of Metals and Plastics by the operator or competent authority as the permit was granted prior to the final BREF being published.** The UK Sector Guidance Notes benchmark information and "BAT-boxes" were taken directly from the draft BREF on Surface Treatment of Metals and Plastics. These BAT-based measures given in the SGN are now outdated given the publication of the finalised BREF document in 2006. On-going UK initiatives to review the Sector Guidance Notes are expected to address this.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains conditions that cover all of the requirements of Article 9(5) concerning monitoring. Further clarification on monitoring is provided by the competent authority's Sector Guidance Note on monitoring, M2. All monitoring is required to be undertaken under the competent authority's monitoring certification scheme, MCERTS[33]. MCERTS is the equivalent of a BAT-based monitoring standard. (Please refer to overview table below.) **Are the monitoring requirements sufficiently detailed?** Yes, the permit notes specific monitoring frequencies and standards which the operator must comply with. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** The key aspects contained within the general principles of the Monitoring BREF appear to have been adequately transposed within UK Technical Guidance on Monitoring (M2)[34] and subsequently this guidance has been used in determining suitable monitoring conditions within the permit (or referencing such monitoring conditions) including the reference conditions, equipment standards, calibration requirements and reporting of monitoring data to the competent authority. **Does the permit include information on duration in relation to monitoring requirements?** The permit specifies British Standards or ISO standards that have a prescriptive method for extractive sampling, which includes minimum duration for monitoring. Conditions are included in the permit that require the operator to use continuous monitoring or extractive annual monitoring for VOCs and continuous monitoring for CO unless the operator can provide technical evidence that the specifications and performance of the oxidiser will ensure that permit ELVs cannot be breached.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	No specific reference to abnormal conditions is made in the permit.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** No. The series of SGNs provide only guidance to the regulatory authorities to determine BAT-based ELVs based on benchmark values in much the same way as BREFs provide guidance to industry and regulators in other Member States. Compliance with or setting permit ELVs in line with those benchmark values set out in the SGN is not mandatory in UK law; rather ELVs should be set within the benchmark range unless there are specific technical characteristics, local environmental conditions or the geographical location is such that setting an ELV within the range is not feasible. In such instances, deviations from the benchmark values should be fully justified within the decision document supporting determination of permit conditions.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** In this instance, it has been judged that the use of BAT can meet all relevant Community EQSs. Based on the UK Environmental Assessment Level (EAL) for copper concentrations in surface inland waterways (hardness 1-50) of 1 mg/l, the permit contains an improvement condition within it requiring the operator to undertake a BAT study to technically assess whether compliance with a level of 1mg/l is possible. The operator has argued that, on the basis that all effluent is discharged to sewer under consent and authorised as such by the permit and meets Urban Waste Water Treatment Directive limits for inland

33 http://www.environment-agency.gov.uk/business/1745440/444671/466158/

34 http://www.sesnews.org/STA-M2.pdf

	water discharges, the application of BAT to achieve this limit is not relevant. This is an ongoing regulatory discussion point.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit issued does not have a limited period of validity. There is no formal date indicated within the permit that states when the permit will be reconsidered or reviewed although the Competent Authority stated that it is due to be reviewed in 2009. The Competent Authority sets review periods on the basis of environmental risk and this permit is allocated a minimum review frequency of at least every 4 years.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes. The application and decision document is made available in paper format in an office providing public access during set hours. **Are monitoring records made available to the public?** Yes. Records are made available upon request and are available in paper format within the public register.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The Operator currently uses an accredited (to MCERTS) external contractor for periodic monitoring of emissions to air. The methods used by the contractor are those specified within the permit. All monitoring undertaken at the installation is extractive and completed once per year. Continuous measurements of CO and VOCs have not been implemented (as required by clause 5.21 in the UK Secretary of State's Guidance for Coating of Metal and Plastic Processes (PGN 6/23(04)). Details on monitoring currently undertaken are given in Table 1.
Operator's compliance with monitoring conditions	The operator presently complies with the majority of the permit conditions relating to monitoring of emissions. The exceptions are as follows: BAT for monitoring of VOCs in the gas stream from the catalytic oxidiser as expressed in the Process Guidance Note 6/23(04) is continuous monitoring until such data has been collected as to demonstrate the efficiency of the oxidiser having regard to the concentration of VOCs. On the basis of continuous data presented by the operator following permit issue, the competent authority indicated that they have used the low risk regulatory principle to remove the requirement for continuous monitoring of VOCs and replace it with the surrogate measures of continuous temperature. The operator complies with this at present. BAT for monitoring of CO in the gas stream from the catalytic incinerator as expressed in the UK's Process Guidance Note 6/23(04) is continuous monitoring. The permit requires (within 24 months of issue) that the operator uses Continuous Emission Monitoring equipment (CEMs) in order to measure emissions of carbon monoxide or to demonstrate that the specification of the catalytic incinerator is such that the CO limit of 100 mg/m^3 cannot be breached (clause 5.21 in Process Guidance Note 6/23(04) as presented in the permit Improvement Programme). The operator is presently developing a BAT study to justify such a deviation on the basis that the high-specification catalytic incinerator results in very low emissions of CO, thereby ensuring compliance with the permit conditions. Technically, the operator is presently in breach of the permit requirements as the 24 month period expired in April 2007. The BREF on Principles of Monitoring does not specify whether or not continuous monitoring is required for these parameters but guides readers as to make a decision on a site-specific basis taking account of emission stability and accuracy of monitoring.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	Emissions monitoring conducted in 2001 on volatile organic compounds (VOCs) shows that emissions were significantly higher than current levels of emissions. The reduction is primarily due to the installation of abatement equipment (solvent incineration) in 2003. Emissions of other pollutants (CO, NO_x) were also reduced, though not to the same extent. Further information on emissions pre-IPPC is provided in Question 16 of the detailed assessment in Appendix A2**.**

Current emissions of key pollutants	This information is provided within the table below. The results presented in the table below were recorded during multiple extractive samples in 2006 (and presented as averages) from the exhaust stack in accordance with permit requirements and using the reference conditions specified in the Process Guidance Note PG6/23(04). All sampling was conducted by a Level 1 MCERTS-certified person. More recent monitoring data were not made available. Particulate emissions from the catalytic incinerator have been indicated by the competent authority to be not significant from the process and therefore are not monitored. The BREF on Surface Treatment using Solvents (2007) does not make a clear conclusion on particular monitoring for emissions from the catalytic incinerator. It indicates that continuous or discontinuous monitoring may be suitable for direct measurement of solvent emissions, TOC, NO_x and particulates.
Assessment of Installation performance against BAT	**Current performance:** Based on 2006 data, the installation performance is well below the permit ELVs. The monitoring contractor noted in the emissions reports that improvements in abatement performance (notably in ammonia emissions from the outstrip line) have reduced emissions since the last extractive test was performed. For those emissions where a comparable BAT-AEL exists, the performance of the installation is within or below the ranges. With regard to other aspects associated with the use of BAT, further information is provided in Question 18 of the detailed assessment in Appendix A2.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The operator completed a Site Condition Report as part of the application for a permit made in 2004 and a further site report has recently been commissioned at the request of the landlord. The assessment found that there are conditions within the permit that require the operator to develop and maintain a suitable site closure plan to ensure that, at cessation of activities, the site is returned to a satisfactory state as defined by the baseline assessment. No evidence was seen for the development of such a closure plan and it is understood that this remains an outstanding action upon the Operator to develop and the Competent Authority to enforce. The competent authority stated that the development of such a plan would feature as a priority in future regulatory schedules.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The competent authority has an inspection schedule for the installation that has been drafted in accordance with the UK's risk rating method for IPPC sites. This stipulates a minimum inspection frequency for this site of 2 inspections per annum. In addition to inspections, the competent authority assesses the results of periodic monitoring data and annual returns completed by the operator. The competent authority has the power and a duty to enforce the regulations and may adopt a wide range of methods for doing this, which includes the use of powers under UK law to serve notices/shut-down/prosecute operators that do not comply. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** For issues of non-compliance (e.g. site closure plan, installation of CEMs), the competent authority has used informal discussions (based on the proportionate regulatory principles using level of environmental risk and historic performance as markers) with the operator to better understand the issues and create resolutions – in some instances this has not resulted in finalisation of specific actions within the date required within permit conditions. No formal sanctions have been applied to this installation. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The Operator maintains an environmental incident register (including compliance breach and abnormal operational events), which is brought to the attention of the board of directors at bi-monthly meetings. Emergency control procedures are in place and the process equipment and abatement equipment are fitted with alarms with action-levels set to 'flag' events with the potential to cause environmental impact or permit condition breaches. **Procedures used or action taken by the operator in the event of non-compliance** As soon as possible, the operator would log the event on the incident register and approach the competent authority to alert them to the incident. Following immediate reparation to address the incident, a Corrective Action Report would be completed and any work necessary resourced and undertaken. Meetings of the site management and operations team are held to discuss areas of potential non-compliance or incidents and the operator highlighted that the specialised nature of the business means

	that there is a requirement to set out such information to the competent authority to provide a good level of understanding and to initiate dialogue.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** 3 inspections have been performed by the competent authority over the past 12 months. The operator has stated that they will participate freely in the inspections, provide unlimited access for the inspector and assist in delivery of any supporting information or technical clarification as necessary.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Results of monitoring are held on the public register and are available upon request. No formal publication of the information is made by the competent authority or the operator. The results of inspections and audits are not routinely made available to the public nor placed on the public register although in accordance with the UK's Freedom of Information Act, such records can be accessed upon request providing there is a suitable justification and no conflicting commercial confidentiality issues.

Key observations from this case study assessment

- The operator submitted an application for an IPPC permit that contained the key elements required by Article 6 that was followed up with limited further information as requested by the competent authority.
- The determination of the permit was made by an external consultant on behalf of the competent authority using guidance documents developed within the Member State which was based on the *draft* BREF document on surface treatment of metals and plastics. The final BREF was not available at the time of the permit determination.
- The conditions within the permit fail to fully address all the requirements of Article 3 - specifically no conditions have been placed in the permit addressing the minimisation, recovery and disposal of wastes generated by the installation. This will be addressed by the competent authority in their permit review procedures in 2009. All other requirements of Article 3 are fully met by the current IPPC permit.
- The permit contains ELVs for the main pollutants to air in accordance with Article 9(3) and the ELVs are set using benchmark values given in national guidance documents, which reflect the BAT-AELs given in the *draft* BREF on surface treatment of metals and plastics. This has resulted in some limits and conditions relating to BAT now being out of date when compared to the finalised BREF published in 2006. The competent authority has requested BAT-based assessments against the finalised BREF and will take the operator's responses into account during the permit review in 2009.
- Water: no ELVs have been set as there are no direct discharges
- The performance of the installation has improved since the implementation of the IPPC permit due to installation of a catalytic incinerator to reduce VOC levels in the exhaust gases (emissions of other pollutants have also decreased). BAT-based measures to optimise process performance are anticipated to result in decreased levels of water and energy use in the future. The emissions from the installation are all within the ranges associated with BAT where such ranges are given and are all below the ELVs set in the permit.
- The competent authority has yet to enforce the permit requirement to produce and agree a site closure plan. The competent authority is aware of this and seeks to address the matter through on-going regulatory reviews and inspections. The competent authority is also aware of the operator's non-compliance with installation of a continuous CO monitor within 24 months and is currently in discussion with the operator on suitable course of action although it is unlikely that formal notices will be served.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/meas-urement time (Note 3)	Reference Conditions	
Emissions to air										
Exhaust stack - catalytic recuperative oxidiser	VOC	8.7 mg/m3	50 mg/m3	20-100 mg/m^3 (STS BREF)	Yes	Yes (below lower end of range)	BS EN 13526	120 minutes	273K	101.3 kPa
	CO	4.9 mg/m3	100 mg/m3	Not given	Yes	N/A	ISO 12039	120 minutes	273K	101.3 kPa
	Particulates	not monitored	50 mg/m3 (note 1)	5-30 mg/m3	N/A	N/A	N/A	N/A	N/A	
	NOx	9.4 mg/m3	100 mg/m3	5-500 mg/m3	Yes	Yes	ISO 10849	120 minutes	273K	101.3 kPa
Strip / Outstrip Line	Ammonia	10 mg/m3	30 mg/m3	Not given	Yes	N/A	USEPA M26	166 minutes – 2 runs	273K	101.3 kPa
HASL Line 1	Lead	0.025 mg/m3	1 mg/m3	Not given	Yes	N/A	BS EN 14385	60 minutes	273K	101.3 kPa
HASL Line 1	Tin	0.01 mg/m3	1 mg/m3	Not given	Yes	N/A	BS EN 14385	60 minutes	273K	101.3 kPa
HASL Line 1	VOCs	4.4 mg/m3	75 mg/m3	Not given	Yes	N/A	BS EN 13284 (note 2)	60 minutes	273K	101.3 kPa
HASL Line 1	HCl	0.4 mg/m3	10 mg/m3	0.3-30 mg/m3	Yes	Yes	BS EN 1911	60 minutes	273K	101.3 kPa

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/meas-urement time (Note 3)	Reference Conditions
Note 1: In response to a request for clarification on why this limit is included but no monitoring data is available, the Competent Authority indicated that the limit of 50mg/m3 comes from the PGN 6/23(04) and relates to a spray coating process. As the installation does not operate such a process, this limit is not relevant and will be removed by the Competent Authority at the permit review stage in 2009. However, it should be noted that the limit set is higher than the BAT-AEL in the BREF. Note 2: The extractive sampling procedure used for monitoring VOC emissions was to sample for Polyethylene Glycol (PEG) measured as particulate weight change on a filter. Sample conducted using an isokinetic CAE sampling system in accordance with BE EN 13284 for particulate emissions. This test is not commensurate with the BS EN 13526 method specified in the permit as it is unlikely to capture VOCs that do not result in a weight change on the filter (e.g. short-chain such as methane/propane). Note 3: No averaging period is given in the BREF. Emissions of fugitive VOC are calculated in accordance with Schedule B of the IPPC permit using a mass-balance equation as defined in the operator's Solvent Management Plan (in accordance with the Solvent Emissions Directive, 1999/13/EC).									
Emissions to water									
Notes: There is no requirement to monitor sewer discharges in the permit. No emissions direct to surface water take place.									
Emissions to land									
Notes: No emissions to land are permitted.									

3.2.6 Surface treatment of metals and plastic (printed circuit board manufacture) – summary

Based on the two case study installations reviewed (Italy and the UK), the following overall conclusions can be drawn:

- Only one of the permits includes ELVs for emissions to air, despite the BREF indicating that emissions to air, in particular VOCs, may be significant. The ELVs for the installation whose permit contains such limits are based on benchmark values in national guidance documents; these in turn are based on the BAT-AELs in the draft BREF document on surface treatment of metals and plastics. All of the relevant ELVs are within the BAT-AEL ranges. For the other installation, ELVs for air emissions are due to be set following the submission of monitoring data by the operator.

- In terms of installation performance for air emissions, the monitoring data provided suggest that, for the one installation with air ELVs set, emissions are all below the permit ELV values and, with the exception of one emission source, all within the range of the BREF BAT-AELs.

- In relation to emissions to water, only one of the two installations has permit conditions setting ELVs (the other has no direct discharges to water). For this installation, the data provided suggest that emissions are below the ELVs set in the permit and also below the upper range of the BAT-AELs set in the BREF.

- Because the BREFs for this sector[35] include emission levels intended to cover a wide range of different activities (other than PCB manufacture), the pollutants for which BAT-AELs are set in the BREF are not all applicable to this activity. This may explain why corresponding ELVs are not included in the permits for these two installations.

- The monitoring undertaken appeared to comply with permit conditions for one installation, with the picture mixed for the other installation, as described above.

- Both of the installations had been inspected by the competent authority at least once within the 12 months prior to the assessment.

The table below provides an indicative summary of the standards and emissions to air of key pollutants from this sector. In particular, it includes information on the relevant BREF BAT-AELs; ELVs set in permit conditions; and actual installation performance. This information is only intended to be indicative of the broad ranges of these values and the reader is referred to the assessments for each installation for further information on the emissions from specific sources and the applicable permit ELVs and BAT-AELs.

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[35] On surface treatment of metals and plastic and on surface treatment using solvents.

Table 3.10 Indicative information on emissions of certain air pollutants from STM installations (BAT-AELs, permit ELVs and actual installation performance)

Member State	Pollutant	BAT-AEL (Note 1)	Permit ELVs (Note 1)	Actual emissions (Note 1)
Italy	All	Various	No permit ELVs	No data
UK	VOC	20-100 mg/m^3	50-75 mg/m^3	4-9 mg/m^3
UK	Particulates	5-30 mg/m^3	50 mg/m^3	Not monitored (Note 3)
UK	NO_x	< 5-500 mg/m^3 (Note 2)	100 mg/m^3	9.4 mg/m^3
UK	Ammonia	N/A	30 mg/m^3	10 mg/m^3
UK	HCl	< 0.3-30 mg/m^3 (Note 2)	10 mg/m^3	0.4 mg/m^3

Notes:

1) Where there are several points at which emissions are measured and ELVs set, the applicable range is quoted. The STM BREF does not include averaging periods for emissions to air. For emissions to water, the emissions monitoring applied the same averaging period (daily) as that specified in the BREF. BAT-AEL for VOCs is based on the BREF on surface treatments using solvents.

2) These values are referred to as indicative emission ranges to air achieved by some installations in the BREF, rather than being explicitly specified as BAT-AELs.

3) Permit ELV is included but emissions not relevant for this installation.

A summary of the overall analysis for these installations is included in Appendix H of this report.

3.3 Combustion installations (coal and lignite fired power plants)

3.3.1 Background to the sector

Coal and lignite fired power plants

The IPPC Directive covers combustion installations with a rated thermal input exceeding 50 MW. The assessment in this report is specifically focused on combustion installations fired with coal and lignite.

According to Eurelectric, approximately one third of the EU's electricity production comes from combustion of solid fuels. Steam cycle coal and lignite plants are in use extensively across Europe and involve conversion of coal and lignite into electricity by burning the fuel and running a steam turbine to drive an electricity generator[36].

As set out in the BREF for Large Combustion Plants (2006), the main processes and techniques applied are:

- Unloading, storage and handling of fuel;
- Fuel pretreatment and preparation;

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36 http://www2.eurelectric.org/content/default.asp?PageID=821, accessed 18 February 2009.

- Fuel combustion (using a variety of techniques);
- Control of emissions to air;
- Water and wastewater treatment and
- Treatment of combustion residues and by-products.

The large combustion plants directive

Directive 2001/80/EC[37], referred to as the large combustion plants directive (LCP Directive), applies to combustion plants with a rated thermal input of 50MW or more. The LCP Directive is a complex directive that places requirements upon Member States to reduce emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_x) and particulate matter (PM or dust) from combustion plants within power plants, petroleum refineries, iron and steelworks and other industrial processes.

According to the LCP Directive, plants licensed after 27 November 2002 ("new-new" plants) have to comply with the emission limit values for SO_2, NO_x and dust in part B of Annexes III to VII. Plants licensed after 1 July 1987 and before 27 November 2002 ("new" plants) have to comply with the emission limit values in part A of Annexes III to VII.

The LCP Directive also requires significant emission reductions from "existing plants" (those licensed before 1 July 1987) to be achieved from 1 January 2008. In particular, it requires either: (a) individual compliance with the emission limit values in part A of Annexes III to VII; or (b) inclusion in a national emission reduction plan that achieves overall reductions calculated using these emission limit values (this is based on mass emissions i.e. tonnes per annum)[38].

The LCP Directive allows existing combustion plants to be exempted from compliance with emission limit values and from inclusion in a national emission reduction plan, provided that the operator undertakes (by submitting a written undertaking to the competent authority by 30 June 2004) not to operate the plant for more than 20,000

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37 OJ L 309, 27.11.2001, p. 1.

38 The Commission considers that it is possible to adopt a "combined approach" for the implementation of the LCP Directive for existing plants, which may consist of: (a) applying a national emission reduction plan for some plants and an emission limit value approach for others for all the compliance periods (2008-2015, 2016-2017, and 2018 onwards); or (b) adopting a national emission reduction plan for a/some compliance period(s) and complying with emission limit values for the rest of the compliance periods; or (c) mixing options (a) and (b).

hours starting from 1 January 2008 and ending no later than 31 December 2015[39]. In general, the emission limit values within the LCP Directive are as set out in the table below.

The LCP Directive sets minimum requirements. However, the IPPC Directive also applies to LCPs, requiring emission limit values based on BAT to be set (or equivalent parameters or technical measures to be used) in the environmental permit. According to the LCP Directive[40]:

- "Compliance with the emission limit values laid down should be regarded as a necessary but not sufficient condition for compliance with the requirements of [the IPPC Directive] regarding the use of best available techniques. Such compliance may involve more stringent emission limit values, emission limit values for other substances and other media, and other appropriate conditions" (Recital 8) and

- The LCP Directive (Article 4(3) and 4(6)) provides for the possibility for Member States to establish a national emission reduction plan for existing installations or to apply emission limit values specified in the LCP Directive to existing plant. However, the plan may under no circumstances exempt a plant from the provisions laid down in relevant Community legislation, inter alia the IPPC Directive. Therefore, even if an installation is covered by a national plan, it still needs to operate in compliance with all the provisions of the IPPC Directive, including a permit containing emission limit values or equivalent parameters and technical measures determined according to the provisions of Article 9(4) or Article 9(8) of the IPPC Directive. "In addition, a certain flexibility is anchored in the provisions of Article 9(4) of the IPPC Directive as well as in the definition of BAT".

According to Article 19(2) of the IPPC Directive, the emission limit values set out in the LCP Directive shall be applied as *minimum emission limit values* pursuant to the IPPC Directive.

The primary focus of the assessments included in this study has been on the IPPC Directive, rather than related Directives such as the LCP Directive. However, the information presented (such as permit ELVs and emissions monitoring data) allows for a comparison to be made with certain provisions of the LCP Directive. However, this was not a primary focus of any of the discussions held (and it should also be noted that this study is not intended as a compliance check with the LCP Directive, nor indeed the IPPC Directive).

Table 3.5 Main emission limit values in the LCP Directive for coal and lignite fired plant (mg/Nm^3, O_2 content 6%)

	50-100 MWth	100-300 MWth	300-500 MWth	>500 MWth
SO_2 – existing and "new" plant (Note 1)	2000	2000 – 400 (linear decrease)		400

[39] The text in the preceding paragraphs is based on the European Commission's website (http://ec.europa.eu/environment/air/pollutants/stationary/lcp.htm).

[40] This information is based on a description in the BREF on large combustion plants.

	50-100 MWth	100-300 MWth	300-500 MWth	>500 MWth
SO_2 – "new-new" plant (Note 1, 2)	850	200 (Note 2)	200	200
NO_x – existing and "new" plant (Notes 3, 4)	600	600	600	500 (until 2016) 200 (from 2016)
NO_x – "new-new" plant	400	200	200	200
Dust – existing and "new" plant	100	100	100	50 (Note 5)
Dust – "new-new" plant	50	30	30	30

Notes:

1) Where these ELVs cannot be met due to the characteristics of the fuel, a rate of desulphurisation of at least 60 % shall be achieved in the case of plants with a rated thermal input of less than or equal to 100 MWth, 75 % for plants greater than 100 MWth and less than or equal to 300 MWth and 90 % for plants greater than 300 MWth. For plants greater than 500 MWth, a desulphurisation rate of at least 94 % shall apply or of at least 92 % where a contract for the fitting of flue gas desulphurisation or lime injection equipment has been entered into, and work on its installation has commenced, before 1 January 2001.

2) Where the ELVs cannot be met due to the characteristics of the fuel, installations shall achieve 300 mg/Nm3 SO2, or a rate of desulphurisation of at least 92 % shall be achieved in the case of plants with a rated thermal input of less than or equal to 300 MWth and in the case of plants with a rated thermal input greater than 300 MWth a rate of desulphurisation of at least 95 % together with a maximum permissible emission limit value of 400 mg/Nm3 shall apply.

3) Until 31 December 2015 plants of a rated thermal input greater than 500 MW, which from 2008 onwards do not operate more than 2,000 hours a year (rolling average over a period of five years), shall (i) in the case of plant licensed in accordance with Article 4(3)(a), be subject to a limit value for nitrogen oxide emissions (measured as NO_2) of 600 mg/Nm^3; (ii) n the case of plant subject to a national plan under Article 4(6), have their contribution to the national plan assessed on the basis of a limit value of 600 mg/Nm3. From1 January 2016 such plants, which do not operate more than 1,500 hours a year (rolling average over a period of five years), shall be subject to a limit value for nitrogen oxide emissions (measured as NO2) of 450 mg/Nm3.

4) Until 1 January 2018 in the case of plants that in the 12 month period ending on 1 January 2001 operated on, and continue to operate on, solid fuels whose volatile content is less than 10%, 1,200 mg/Nm3 shall apply.

5) A limit value of 100 mg/Nm3 may be applied to plants licensed pursuant to Article 4(3) with a rated thermal input greater than or equal to 500 MWth burning solid fuel with a heat content of less than 5 800 kJ/kg (net calorific value), a moisture content greater than 45% by weight, a combined moisture and ash content greater than 60% by weight and a calcium oxide content greater than 10%.

3.3.2 Key environmental issues and BAT

For many Member States in the EU-27, coal and lignite-fired power stations are a primary source of electrical power and form the core of the generation capacity across Europe. The total rated thermal input of the coal or lignite-fired units within power stations varies widely amongst Member States with a range of 50MW to 4,000MW. The installations assessed as part of this project are those subject to IPPC, which sets a threshold of greater than 50MW although by the nature of the selection criteria, the installations examined in this study are typically larger with combined thermal inputs of greater than 1,000MW (with some exceptions).

The main environmental impacts result from the combustion process, which leads to the generation of emissions to air and, in some cases, also to water and soil. The most important polluting substances emitted to air from the combustion of fossil fuels are SO_2, NO_x CO, particulate matter (PM_{10}) and greenhouse gases, such as CO_2 and N_2O. Other substances such as heavy metals, halide compounds and dioxins are emitted in smaller quantities although it is worth noting that given the acute toxicity of some of these compounds, smaller absolute quantities can have potentially significant environmental effects. Most of the heavy metals considered (As, Cd, Cr, Cu, Hg, Ni, Pb, Se, V, Zn) are normally released as compounds (e.g. oxides, chlorides) in association with particulates.

In addition to environmental impacts from emissions and the residues collected from pollution abatement equipment and the combustion process itself, there are a number of other potential environmental impacts. These include those associated with transportation, storage, handling and use of large quantities of coal and lignite from mines (typically outside the control of the integrated permit) to the site, which may give rise to impacts such as noise, dust and water contamination. To some degree, these effects can be mitigated through the application of techniques such as enclosed conveyors, water sprays, covered storage and filtration. Appropriate re-use of secondary materials such as boiler ash and synthetic limestone from flue gas desulphurisation (FGD) is also a key environmental concern to minimise the waste produced and its subsequent disposal.

The table below provides examples of the types of techniques considered to represent BAT (examples of general conditions not directly related to BAT-AELs). This is taken from the BREF on large combustion plant (July 2006) which contains significant further details and should be referred to for further information

Table 3.6 Examples of BAT from the BREF on Large Combustion Plant for lignite or coal fired plants (general conditions not directly related to emissions of specific pollutants)

Element	BAT
Generic BAT	Implement an effective environmental management system.
Unloading, storage and handling of fuel	Reduce the generation of dust in coal and lignite handling, storage and use through a combination of techniques as defined in the LCP BREF in table 4.65 (pp.267). BAT include direct and covered conveyors for transport from mines to storage pits, minimising fuel drop height into storage areas, reducing fugitive dusts by use of grassing-over long-term storage areas, water sprays, conveyor cleaning and filtration systems and rationalisation of transport systems. BAT is also to operate sealed storage areas and collect run-off water to prevent surface and groundwater contamination from stored materials and additives to minimise fire risk through preventative checks and monitoring.
Fuel pre-treatment, combustion and thermal efficiency	It is BAT to pre-treat coal and lignite fuels by adequately mixing them to ensure stable combustion conditions and where practicable, to switch to fuels with better environmental profiles (higher specific calorific value, lower sulphur levels, etc.) For the combustion of coal and lignite, pulverised combustion (PC), fluidised bed combustion (CFBC and BFBC) as well as pressurised fluidised bed combustion (PFBC) and grate firing are all considered to be BAT for new and existing plants. For the design of new boilers or retrofit projects for existing plants, those firing systems are BAT that assure a high boiler efficiency and which include primary measures to reduce the generation of NO_x emissions, such as air and fuel staging, advanced low-NO_x burners and/or reburning, etc. The use of advanced computerised control systems in order to achieve a high boiler performance with increased combustion conditions that support the reduction of emissions are also considered as BAT. For thermal efficiency with regard to existing plants, BAT can be considered to be measures during any upgrade or retrofitting that contribute to an increase of +3% on baseline efficiency or an efficiency range of 36-40%.
Combustion residues	The residues from combustion and associated flue gas treatment should be recovered and re-used where practicable. BAT has not been defined in the LCP BREF for specific re-use as there are a great many potential applications, each requiring the residues to meet a specific quality.

3.3.3 Main emissions and levels associated with BAT

The information below is taken from the BREF on large combustion plant (July 2006) which contains significant further details and should be referred to for further information.

It should be noted that the LCP Directive uses the term "stack" which refers to the structure (providing a conduit for combustion gases) rising above roof level which may embody one or more "flues" (a compartment or division of a stack (or chimney) for conveying combustion gases to the outer air). This is understood to be the interpretation applied when setting ELVs under the LCP Directive. The IPPC Directive and LCP BREF are not clear on this point, though it may be assumed that this approach should also apply here.

The following tables provide details of the techniques specified as BAT and the associated emission levels *as defined in the LCP BREF*. Unless otherwise stated, the BAT associated emission levels for air emissions are daily average values, expressed at standard conditions and an O_2 level of 6 %, and represent a typical load situation.

Dust (particulates)

Table 3.7 BAT for reduction of particulate emissions from coal and lignite fired combustion plants

Capacity (MWth)	Dust emission level (mg/Nm^3) associated with BAT		BAT to reach these levels
	New plants	Existing plants	
50-100	5-20 (Note 2)	5-30 (Note 2)	Electrostatic precipitators (ESP) or fabric filter (FF)
100-300	5-20 (Note 2)	5-25 (Note 2)	ESP or FF in combination with flue-gas desulphurisation (FGD)(Note 1)
>300	5-10 (Note 2) for PC 5-20 (Note 2) for CFBC	5-20 (Note 2)	

Notes: 1) FGD techniques include wet limestone scrubbers, spray dryer scrubbers or dry sorbent injection
2) Some split views in relation to these figures – refer to BREF sections 4.5.6 and 6.5.3.2 for more information. CFBC = circulating fluidised bed combustion; PC = pulverised combustion.

BAT is to have continuous monitoring of dust emissions.

Heavy metals

BAT to reduce heavy metals is generally use of high-performance ESPs (> 99.5% efficiency) or FFs (> 99.95% efficiency).

When using these particulate matter control devices, collection of mercury can be highly variable. However combined with FGD techniques and when using bituminous coal an average removal of 75% has been noted and 90% in the additional presence of selective catalytic reduction (SCR).

For mercury, periodic monitoring (every year up to every third year) is BAT.

Oxides of nitrogen (NO_x)

Table 3.8 BAT for reduction of NO_x emissions in coal and lignite fired combustion plants

Capacity (MWth)	Combustion Technique	Fuel	NO_X emission level (mg/Nm^3) associated with BAT		BAT to reach these levels
			New plants	Existing plants	
50-100	Grate firing	C & L	200 – 300	200 – 300*	PM and/or SNCR
	PC	C	90 – 300	90 – 300	Combination of PM and SNCR or SCR
	BFBC, CFBC, PFBC	C & L	200 – 300	200 – 300*	Combination of PM
	PC	L	200 – 450	200 – 450*	Combination of PM
100-300	PC	C	90 – 200	90 – 200*	Combination of PM in combination with SCR or combined techniques
	PC	L	100 – 200	100 – 200*	Combination of PM
	BFBC, CFBC, PFBC	C & L	100 – 200	100 – 200*	Combination of PM together with SNCR if necessary
>300	PC	C	90 – 150	90 – 200*	Combination of PM in combination with SCR or combined techniques
	PC	L	50 – 200	50 – 200*	Combination of PM
	BFBC, CFBC, PFBC	C & L	50 – 150	50 – 200*	Combination of PM

Combustion Technique: **PC** (pulverised coal), **BFBC** (bubbling fluidised bed combustion), **CFBC** (circulating fluidised bed combustion), **PFBC** (pressurised fluidised bed combustion).

Fuel: **C** (coal), **L** (lignite)

Abatement: **PM** (primary measures such as air and fuel staging, low NO_x burners, reburning, etc.) **SCR** (selective catalytic reduction of NO_x), **SNCR** (selective non-catalytic reduction of NO_x)

* Some split views in relation to these figures – refer to BREF sections 4.5.8 and 6.5.3.3 for more information

BAT is continuous monitoring of NO_x emissions on all plants.

Sulphur dioxide

Table 3.9 BAT for reduction of SO_2 emissions from coal and lignite fired combustion plants

Capacity (MWth)	SO_2 emission level (mg/Nm^3) associated with BAT		BAT to reach these levels
	New plants	Existing plants	
50-100	200-400* 150-400* (FBC)	200-400* 150-400* (FBC)	Low sulphur fuel or/and FGD (dsi, sds or wet depending on the plant size). Seawater scrubbing. Combined techniques for the reduction of NO_x and SO_2. Limestone injection (FBC). ***(Simplified – refer to BREF for further information.)***
100-300	100-200	100-250*	
>300	20-150* 100-200 (CFBC/PFBC)	20-200* 100-200* (CFBC/PFBC)	

Combustion Technique: **FBC** (fluidised bed combustion), **CFBC** (circulating fluidised bed combustion), **PFBC** (pressurised fluidised bed combustion).

Abatement: **FGD** (flue gas desulphurisation). Note that dsi = dry sorbent injection; sds = spray dry scrubbers.

* Some split views in relation to these figures – refer to BREF sections 4.5.8 and 6.5.3.3 for more information

BAT is continuous monitoring of SO_2 emissions on all plants.

CO emissions

BAT for the minimisation of CO emissions is complete combustion, along with good furnace design, use of high performance monitoring and process control techniques, and maintenance of the combustion system. A well optimised system to reduce NO_x emissions will keep CO down to 30-50 mg/m^3 for pulverised combustion and below 100 mg/m^3 for fluidised bed combustion. Lignite-fired plants, for which BAT for NO_x are mainly primary measures, can have higher levels of CO (100-200 mg/m^3).

Hydrogen chloride (HCl), hydrogen fluoride (HF) and ammonia (NH_3)

Where wet scrubbing is implemented for abatement of SO_2 emissions, emissions of HF and HCl are also reduced (by 98-99%). When using a wet scrubber or spray dryer, BAT-AELs for HCl are in the range 1-10 mg/m^3 and for HF in the range 1-5 mg/m^3. Where FGD is not employed, levels may be much higher. For limestone injection (BAT for SO_2 in the case of CFBC), the BAT-AEL for HCl is 15-30 mg/m^3.

Unreacted ammonia emissions from SCR and SNCR systems (ammonia slip) should be reduced. BAT associated emission levels are considered to be less than 5 mg/m^3. To reduce ammonia slip with the SNCR technique, a low level of SCR catalyst may be installed in the boiler.

Water contamination

Oil separation wells are BAT. A wastewater treatment plant is required where there is wet scrubbing desulphurisation – this should include pH adjustment, precipitation of heavy metals and removal of solid matter. Further information on BAT, main environmental benefits and associated emission levels are presented in the LCP BREF document in Table 4.70 and 4.71 (pp. 280-281).

3.3.4 Case study 1 – Greece

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/EL/12. The information in this table is based on the detailed assessment for this installation in Appendix B1. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is a lignite-fired power station consisting of 5 units and a total rated thermal input of 1595 MW. The plant has been operational since 1984. The first two units (I and II) have been running since 1984 and are of 300MWth input each. Units three and four (III and IV) became operational in 1985 (III) and 1986 (IV) and are each rated at 310 MWth input. The fifth unit is operational since 1997 and has a rated thermal input of 375 MWth. The installation operates five separate stacks, one for each boiler unit. The annual generation of the station is 11,500,000 MWh, which covers approximately 20-25% of the national Greek electricity consumption. The plant is fired on lignite, approximate consumption 1.8 tonnes/MWh or 21,000,000 tonnes per annum. The ash content is approximately 18%, water 50% and specific calorific value 5-5.4 MJ/kg, which is one of the lowest amongst carbon-based fuels. Average sulphur content is 0.4-0.6% w/w. The station uses 27,000,000 tonnes of water per annum, with a specific consumption of 1.3 tonnes/MWh. The station operates a range of treatment facilities, including electrostatic precipitators and an integrated wastewater treatment works. Many of the wastes produced are recovered and/or recycled in accordance with the terms of their IPPC permit.
Type of permit / issue date	The IPPC permit is new, having been issued under transitional arrangements into IPPC from a previous regulatory regime. The permit is dated 12/09/2006.
Basis of BAT determination	The competent authority has determined BAT through a combination of assessment of the operator's submission of BAT (made as part of the technical reports that are required for the IPPC application) and cross-reference to BREF documents, primarily the reference document on Large Combustion Plants, the country's split views (as included in the BREF), as well as the criteria of Article 9(4) and Annex IV of the IPPC Directive.
Permit application	
Requirements of Article 6	The operator made two applications to cover the installation (a primary application and a supplementary application containing additional technical information). The application contained the key elements required by Article 6 although the competent authority noted that a formal request was made for the operator to prepare a more detailed technical report on proposed technologies for reducing or preventing emissions. Particular focus was on particulate matter emission reductions.

Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit is a comprehensive document containing a mixture of general and specific conditions that meets most of the requirements set out in Article 3(a)-(f) of Directive 2008/1/EC. The permit does not include any specific or general conditions on the minimisation of energy or the requirement to produce an energy-efficiency plan (reference to Ministerial Decree on energy efficiency), nor does it contain conditions requiring the development and submission of a site closure plan in advance of closure. The assessment shows that there is a significant focus on managing the primary air emissions (particulates, SO_2 and NO_X), water minimisation and recycling and liquid and solid waste management, including recovery. The permit contains a significant number of conditions relating to the minimisation of fugitive dust emissions as this is seen as a significant local impact issue in very dry periods. Where the determination process has shown the installation is not currently using BAT, the permit contains specific improvement conditions (date unknown) that require the operator to implement BAT techniques as set out in the BREF on large combustion plant. These measures are summarised within Section A.9 of the permit.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** The permit sets limit values for the main polluting substances. It contains concentration-based ELVs for particulates, NO_x and SO_2, which have been based upon and are equal to the limit values indicated within the LCP Directive (2001/80/EC). The limits are effective from 30.09.2007. Prior to this, the emissions had been controlled by the national limits in Ministerial Decree KYA 29457/1511/2005. Concentration-based ELVs have also been set in the permit for dust emissions from the boiler room stack and for emissions of cadmium and mercury. The permit contains an ELV for dust emission of 100 mg/m^3 from the cyclones fitted on the ash slurry silos. The permit also sets mass limits for: ▪ SO_2 of 9000 tonnes/year/unit (units I-IV), 3000 tonnes/year/unit (unit V); ▪ NO_x of 13,000 tonnes/year/unit (units I-IV), 4,000 tonnes/year/unit (unit V) These mass limits in the permit were valid only until the issue of the National Emission Reduction Plan values (NERP) and are valid with maximum exceedance of 305 tonnes/year (units I-IV) and 65 tonnes/year (unit 5). Since the revised NERP has been issued (summarised in the meeting), it is understood that these values are no longer valid. The NERP published in August 2008 issued (August 2008) with the following values: ▪ SO_2 - 22,640 tonnes per annum (from 2008) ▪ NO_x – 28,300 tonnes per annum (2008-2015), 11,320 tonnes (2016+) ▪ Particulates – 5,660 tonnes per annum (2008 onwards) These NERP values replace the original mass emission limits within the permit and are valid from their introduction in late 2008 (the site visit for this installation took place towards the end of 2008). It is unclear as to whether the NERP limits are binding or tradable. **Water:** ELVs (and other relevant conditions) have been set in the permit for all discharges made to water. These are based on national values developed by the Ministry for Water and transposed into national legislation in the form of Ministerial Decisions. The competent authority noted that the national legislation requires compliance with the requirements set within Directive 76/464/EEC (dangerous substances in water). **Land:** No ELVs have been set in the permit for emissions to land. **Protection of soil and groundwater** No ELVs have been set. **Waste** No ELVs have been set. **Transboundary considerations** It is understood that the procedure for taking into account transboundary pollution was done in accordance with Article 17. The permits indicate that conditions are not required in order to control

	transboundary pollution as the impacts are not likely to adversely affect the environment and air quality of neighbouring Member States. **Further equivalent technical parameters/measures have been set for:** The permit contains the following equivalent technical measures: ▪ The operational removal efficiency of the ESPs for units 1-4 shall be >99.5%. ▪ The operational removal efficiency of the ESPs for unit 5 shall be >99.9%. ▪ The use of supplementary fuels (e.g. diesel fuel during start-up) is subject to the fuel meeting the minimum requirements of the low-sulphur in fuels Directive.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** The permit ELVs relating to the LCP units are not based directly upon BAT as presented within the BREF on large combustion plants. The competent authority stated that installation-specific BAT implementation has been based on the BAT determined at European level in the BREF LCP, along with the country's split views (as included in the BREF LCP) and Article 9(4) as well as Annex IV of IPPC. This is designed (by the authorities) to ensure that all European Directive requirements are effectively transposed into installation-level control measures. The priority in setting ELVs for the competent authorities is those Directives where emission limits are presented (e.g. LCPD). The conditions set within the permit as compared to BAT (see the introductory section on LCPs) can be summarised as follows: Dust ▪ The permit conditions for abatement of dust emissions are judged to be in line with BAT. Although wet scrubbing is not required, the units are required to achieve the minimum removal efficiencies stated in the BREF. ▪ The ELVs set for dust (50/100 mg/m^3) exceed the BAT-AELs. NO_x ▪ The permit conditions for abatement of NO_x require a combination of primary measures to be used and are therefore in accordance with and based on BAT. ▪ The permit ELVs set for NO_x emissions are not equivalent to BAT-AELs. SO_2 ▪ The permit conditions for abatement of SO_2 do not require FGD on the basis of the operator's justification that low-sulphur coal and natural de-sulphurisation achieves a level that would be equivalent to dry sorbent injection. ▪ The ELVs are based on the values set in the LCP Directive and are not equivalent to BAT-AELs. Other activities and impacts (such as storage, transportation, reduction of fugitive emissions and treatment/recovery of combustion residues) have been considered and permit conditions are based on BAT as presented in the BREF.

	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? In conjunction with the regional and district authorities, for LCPs the competent authority assesses the suitability of setting ELVs based directly on transposition from European Directives (LCP Directive) having regard to any particular local factors, including the geographic location, ambient air and water qualities and public sensitivities. According to the authorities, the geographic distribution of power stations, mines and other significant industrial installations in close proximity in the region was of concern when assessing the suitability of setting ELVs at the levels given within the LCP Directive, and in particular the combined impact of so many activities within the same area.. The operator and competent authority both commissioned several technical studies of the local environmental quality (ambient air and water) against national standards and those set within the Air Quality Directives. The competent authority were concerned that the concentrations of dust were higher than national averages and therefore this was of primary concern when determining whether transposing ELVs directly from the LCPD would be sufficient to ensure adequate protection of local air quality standards (no information was available for this assessment on whether concentrations were above EU ambient air quality limit values). The requirement to fit BAT-based abatement for dust removal (ESP's >99.5% efficiency) was based on the local factors, as was the requirement to seal the transport road from the mines, cover the ash conveyors and require only covered silo trucks to transport fly ash and pulverised fuel ash. Emissions and local ambient air concentrations of NO_x and SO_2 were not considered to be of such a high priority and on the basis of extended monitoring of ambient air pollutant concentrations, the competent authority determined that the operator's proposals to use primary measures (for NO_x reduction) and no FGD, instead relying on natural desulphurisation, was "BAT" for this plant. The issue of "natural desulphurisation" is believed to relate to the high calcium/sulphur ratio of the fuel used.
	Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)? None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** None observed.
Use of relevant BREF documents in setting permit conditions?	The operator made a comprehensive assessment of actual operations against BAT as presented in the BREF document on Large Combustion Plant. The operator presented the conclusions at the meeting and these were the result of a significant amount of technical work. It was clear that the BREF conclusions had been clearly investigated and measures taken in a number of areas to upgrade the plant to BAT standards. This information was used by the competent authority in determining permit conditions and reaching a conclusion on site-specific BAT for this installation. There is evidence within the permit that a large number of general and operational conditions have been set in accordance with the requirements given in the BREF.

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains a wide range of conditions relating to the requirement for the operator to monitor emissions. The measurement method, frequency and evaluation process are specified or references made to the relevant national laws. The operator was required as part of the permit improvement programme to install continuous monitoring systems for the key air pollutants (see table at end of case study) on all units by 2007. This is not however in line with LCPD Annex VIII(A) which required such monitoring from 27 November 2002. The permit includes a condition that obliges the operator to produce and submit reports on defined frequencies (monthly/annually). **Are the monitoring requirements sufficiently detailed?** The requirements are sufficiently detailed. **Do the monitoring requirements take into account the details contained within the BREF documents?** Monitoring requirements are based on BAT as presented within the operator's proposals. Where it was judged by the competent authority that improvements to bring the measures in line with BAT were required, these are explicitly listed in the permit improvement programme (e.g. continuous monitoring). Water discharges require continuous composition samples or at least 3 spot-samples in 24 hours (with >2 hours between samples). **Does the permit include information on duration in relation to monitoring requirements?** Yes.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Yes, the permit contains a number of conditions relating to measures and procedures that must be followed in the event of abnormal operation or fault conditions.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** GBRs (Ministerial Decisions and national laws) are used to set permit conditions such as monitoring requirements, ELVs and general operational conditions. These rules were referred to within the permit document. The competent authority noted during the site visit that the responsibility for compliance with national regulatory/legislative requirements (GBRs) remained the responsibility of the operator.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The ELVs as set within the permit, which do not go beyond BAT, have been assessed by the authorities having regard to local conditions and judged to be sufficient to ensure that relevant EQSs (Community – Air) (National – Water) are met. Stricter conditions were not deemed by the competent authority to be required in this case.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit is valid for a period of 7 years, after which time, the operator must prepare and submit a new application.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes. The competent authority makes the key documents available such as the application non-technical summary and results of the environmental impact assessment (no EIA was required with the IPPC permit application in this case). The decision on BAT (permit determination) is also made available to members of the public upon request. **Are monitoring records made available to the public?** Yes, upon request to the Ministry or by visiting the main Athens offices. The operator indicated that they would make this information available upon request from a member of the public but do not routinely publish the data.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	**Air emissions** A programme of developing a continuous emissions monitoring system (CEMs) for air emissions (dust, NOx, SO2, CO, CO2) from the combustion plants (boiler stacks and ESPs) has been in place at the installation since 2006. This includes electronic live monitoring for all five units. Boilers 1-4 have had continuous monitoring of dust since permit issue and other parameters since 2008. Boiler 5 has had continuous monitoring since permit issue. Periodic monitoring is used for all remaining point source emissions. All continuous emissions equipment is certified to Quality Assurance Level 2 (QAL 2) standards (in line with EN 14181: Quality Assurance of Automated Measuring Systems) and the permit requirements include independent calibration and testing on an annual basis. **Water emissions** Continuous monitoring of pH and flow. Periodic monitoring (at least 3 spot-samples in 24 hours (with >2 hours between samples)) of temperature, colour, dissolved solids, suspended solids, total oils and conductivity (Weekly). Periodic monitoring of trace and heavy metals, nitrogen, phosphorous, fluorine and boron (Monthly). **Other** On-line efficiency performance evaluation project (2006) to monitor boiler unit efficiency (total and partial).
Operator's compliance with monitoring conditions	Yes, based on discussions with both the operator and competent authority, the installation presently complies with all elements of the permit. The operator has made a significant number of improvements in line with BAT as presented within the BREF document on large combustion plant.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	The operator provided quarterly monitoring data (aggregated monthly averages) for SO_2 and NO_x emissions from units I-IV as follows (boiler V is not included as this was not active during this period due to commissioning): **SO_2 (mg/m^3)** 2004: 40 (I) / 32 (II) / 49 (III) / 74 (IV); 2005: 127 (I) / 127 (II) / 83 (III) / 152 (IV); 2006: 524 (I) / 238 (II) / 422 (III) / 652 (IV); **NO_X (mg/m^3)** 2004: 316 (I) / 300 (II) / 285 (III) / 274 (IV); 2005: 326 (I) / 291 (II) / 269 (III) / 295 (IV); 2006: 420 (I) / 347 (II) / 313 (III) / 407 (IV); The emissions monitoring data shows the general trend that SO_2 emissions fluctuate far more than NO_x due to the different composition of the lignite fuel; primarily the concentration of calcium. SO_2 emissions have increased over this period, as have NO_x emissions, though to a lesser extent.
Current emissions of key pollutants	**This information is provided within the table below** The results presented in the table below were sent by the operators following the interviews. An examination of the available data indicates that permit ELVs are being met for particulates and NO_x but not for SO_2.

Assessment of Installation performance against BAT	**Current performance:** On the basis of the emission data submitted (2007), it is clear that the emissions fluctuate between units and are very dependent upon the characteristics of the lignite fuel. **SO_2** The data taken from quarterly periodic measurements during 2007 (6-8 hourly interval sampling averaged over 3 days) shows that the three of the four boiler units were periodically operating above a level of 400 mg/m^3, which would not comply with the ELV that came into force in September 2007. Having asked for explanation at the meeting as to why this is, the operator cited the characteristics of the lignite as the key factor. The emissions of SO_2 are, as indicated by the operator, subject to very large fluctuations because the SO_2 concentration is directly related to the ability of the natural calcium within the lignite to de-sulphurize the gases generated during combustion. The operator highlighted that, in accordance with BAT, they have made some significant measures to reduce the fluctuations (fuel mixing, staged sorting and loading from different bunkers, etc). An visual check on on-line 'live' monitoring data (available at the installation only) for all five boiler plants at the meeting in November 2008 demonstrated this fluctuation. Emissions of SO_2 did fluctuate but were all demonstrated as being within the ELV of 400mg/m^3 on the day of evaluation. For a period exceeding 30 minutes, emissions of SO_2 were around the 10mg/m^3 mark. Based on this single 'snap-shot' made during the meeting in 2008, it was clear that there are substantial and wide-ranging fluctuations in the concentration of SO_2 within the gas stream. Despite the introduction of measures such as low sulphur fuel (<1%), fuel mixing and staged combustion feed from different source bunkers, there remains a significant level of fluctuation of the SO2 emissions. The achieved 70% reduction of SO_2 equates to the minimum level of performance anticipated by using dry sorbent injection (which is not listed as BAT in the BREF for lignite fired plants over 200MW). The BAT conclusions are that low sulphur fuel should be used in combination with other SO_2 reduction techniques (wet FGD, seawater scrubbing, DESOX) and therefore on this basis, it can be concluded that the installation is not applying a combination of the measures considered to be BAT as presented in the BREF on large combustion plant. The LCP Directive requires that a higher desulphurisation rate be achieved (92-94%) where the LCP Directive ELVs cannot be met due to the characteristics of the fuel. The Ministry has commented on comparison with BAT and indicated that "the installation applies BAT, as implemented specifically according to IPPC, taking into account the BREF LCP, the cited country's split views, Article 9 (4) and Annex IV of the IPPC Directive". **NO_x and Particulates** Emissions of NO_x were shown to be far more stable than those for SO_2, with a range of between 200 - 450 mg/m^3 (quarterly 6-8 hourly interval sampling averaged over 3 days for boilers 1-4; continuous half-hourly averages for boiler 5). Emissions of particulate matter are now well below 10 mg/m^3 for all units due to the new ESPs coming on-line during the last 12 months. The raised emissions of particulates from unit III were due to a fault and subsequent shut-down of the unit for maintenance. **Other** Given the fact that the installation does not use FGD, the added benefits of emissions reductions of heavy metals are not realised and therefore the use of ESPs as a sole method of abatement of heavy metal emissions may not represent BAT. The Ministry highlighted that "nevertheless, the installation complies with the BAT conclusion on heavy metals, i.e. '… is to use a high performance ESP (reduction rate>99.5%) …'". At the site visit, the operator highlighted that further assessment and monitoring following installation of the ESPs is necessary to reach an adequate conclusion on this issue.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	It is not clear within the permit conditions that the operator is required to produce a formal site closure plan. The operator is required by the IPPC law within Greece to make adequate provision for ensuing that the site is returned to a satisfactory state following final closure and although the operator has not developed a formal plan yet; they were aware of the obligations upon them to undertake and make provision for this.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the competent authority for ensuring compliance:** The primary measures for checking compliance are performed by the inspection division of the competent authority. The inspectorate undertakes a review of submitted monitoring data on a regular basis and supports this with on-site compliance inspections. The local prefecture also retains the right of on-site inspection for wastewater treatment processes/discharges. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** There are a range of measures that can be taken in the event of non-compliance with permit conditions. These include informal and formal communications, enforcement actions (improvements) and suspension/permit revocation. In this instance, the operator previously reported (through monitoring data) a non-compliance with emission limits set for boilers I-IV for SO_2. The competent authority indicated that they did not take any action other than communicating with the operator. The reason for the breach was due to the character of the lignite (low in natural calcium). Based on the fact that exceedence was reported on more than a single occasion, the fact that the competent authority did not take any enforcement action in this case may be considered to be not in accordance with the Directive 2008/1/EC (Article 14(a)). **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The operator has developed a range of IPPC permit compliance matrices and written the key compliance elements into procedures, which have been briefed to all members of staff in training. The operator maintains a formal EMS and references the requirements within this system to enable adequate training to be provided to educate employees regarding the importance of system checks and monitoring with regard to permit compliance. Daily operational checks are undertaken on key elements, including process control, monitoring and compliance with IPPC. Any operational deviation must be communicated back to the environmental team and there are corporate and site-level environmental audits. **Procedures used or action taken by the operator in the event of non-compliance** In the event of non-compliance, there is initial communication to the environmental department. The competent authority would be informed as soon as practicable (within 24 hours in most cases) and corrective actions would be implemented, which may include emergency response. Accident management and mitigation reports are developed and key management roles briefed. Preventative actions will be implemented where necessary. As indicated above, this process does not appear to have been followed in its entirety for the reported exceedances of the SO_2 emission limits.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The inspectorate department of the competent authority conducts on-site inspections. Typically, the inspectorate would undertake 1-2 major audits per annum with minor audits where necessary or in response to non-compliance. Both the operator and competent authority highlighted that the operator is required by law to cooperate and provide assistance as may be necessary to the inspectorate. It was not clear at the meeting how inspections were used to ensure compliance given the highlighted breach of the SO_2 limit during 2007.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** The results of monitoring are available upon request.

Key observations from this case study assessment

With the exception of BAT-based ELVs for the key air pollutants the assessment shows that the permit has been issued in accordance with the requirements of the IPPC Directive. This is supported by the following findings:

- There is a single IPPC permit covering the main activities at the installation.
- The application contained all the key elements required by Article 6. The operator also produced a comprehensive BAT comparison that considered existing processes and equipment in light of other techniques/technologies given within the BREF on large combustion plant.

- The permit as assessed is a comprehensive document containing a mixture of general and specific conditions that meet most of the requirements set out in Article 3(a)-(f) of Directive 2008/1/EC, having regard to the fact that the permit references the national requirements on energy efficiency. A site closure report is not required under the current terms of the permit.
- Where the determination process has shown the installation is not currently using BAT, in most cases, the permit contains specific improvement conditions that require the operator to implement measures based on BAT.
- ELVs have been set for all sources of air and water emissions. The basis for setting these ELVs has been on Ministerial Decisions that transpose European legislation into Greek national law. The Ministry has indicated that the installation applies BAT, as implemented specifically according to IPPC, taking into account the BREF LCP, the cited country's split views, Article 9 (4) and Annex IV of the IPPC Directive. The ELVs for the large combustion plant have been set directly using values from the LCP Directive 2001/80/EC. The ELVs came into force on 30.09.07. However, with the coming into force of the Greek LCP Directive national emission reduction plan (NERP), the relationship between these ELVs and the mass limits for the plant set in the NERP are unclear and no explanation was provided by the competent authority to clarify the situation further (see further notes below).
- ELVs have not been based on BAT but have been transposed directly from Directive 2001/80/EC. The suitability of these ELVs has been assessed by the competent authority on the basis of local environmental impacts and air/water quality standards protection. The conclusions are that the ELVs as set are not in line with the BAT-AELs.
- An assessment of the main permit conditions other than ELVs for air emissions against BAT as given in the BREF on large combustion plant shows that these are based on BAT.
- The permit includes a series of detailed conditions relating to the requirement for the operator to monitor emissions. The permit required the operator to implement continuous monitoring of emissions from all boiler units by 2007. The permit conditions oblige the operator to produce and submit reports on defined frequencies (monthly/annually). However, these monitoring requirements came into effect after the deadline set in the LCP Directive.
- The permit has a suitable period of validity (7 years) and there was evidence that the permit, application and monitoring records are available to members of the public upon request.
- On the basis of the current data available (for 2007 this is quarterly monitoring with 6-8 hourly interval sampling averaged over 3 days for boilers 1-4 (SO_2/NO_x) continuous monitoring reporting 48 hour averages (based on half-hourly average values) for boilers 1-4 (dust) and all parameters on boiler 5)), operational performance against BAT-AELs shows that the installation does not meet BAT-AELs for SO_2 or NO_x but meets BAT-AELs for particulates for boilers I, II and IV. ESPs are anticipated to reduce emissions of particulates to levels equivalent to BAT-AELs.
- Exceedances of SO_2 emission limits were reported for 4 out of 5 units during 2007. The competent authority did not take enforcement action against the operator in this case.

Further Notes. Quotation from the Greek NERP (August 2008) on compliance with the National Emission Reduction Plan (NERP):

1. Compliance with the National Emission Reduction Plan is achieved when the annual emission targets are met for each pollutant mentioned in Table A2 of the Annex of Article 4, by all the existing large combustion plants of the country.

2. Each operator is allowed for each pollutant total annual emissions equal to the sum of the contribution to the annual target of all the operator's large combustion plants that fall under NERP for each pollutant, as given in Table A2 of the Annex of Article 4 (hereinafter, operator's annual target).

3. Non-compliance with NERP does not apply in the following cases:

a) When the total annual emissions from all the operator's existing large combustion plants do not exceed its annual target for each pollutant and

b) When one or more operators exceed their annual targets, but the national target is not exceeded.

This paragraph does not impair the implementation of the sanctions provided for in article 14 of joint ministerial decision no. 29457/1511/2005, against an entity being in breach of its provisions.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
LCP point source emissions									
Boiler units I-IV	Particulates	1) 5.37 mg/m^3 2) 4.57 mg/m^3 3)158.8 mg/m^3 4) 81.27 mg/m^3	100 mg/m^3	5-20 mg/m^3	Yes[1]	NO (but yes in some cases)	Periodic monitoring – quarterly in accordance with national standards	6-8 hourly interval sampling averaged over 3 days (Permit indicates 48h average and monthly average values.) (BREF indicates daily averages.)[3]	101.325kPa O_2 4-6% (measured) 273K
	SO_2	1) 777 mg/m^3 2) 639 mg/m^3 3) 172 mg/m^3 4) 654 mg/m^3	400 mg/m^3	20-200 mg/m^3	No[2]	No			
	NO_x	1) 461 mg/m^3 2) Not Operating 3) 199 mg/m^3 4) 296 mg/m^3	500 mg/m^3	50-200 mg/m^3	Yes	No			
	Cd	No data	10 mg/m^3	No BAT-AEL	Not known	N/A			
	Hg	No data	0.3 mg/m^3	>75% reduction	Not known	N/A			
	Smoke	No data	Ringelmann1	N/A	N/A	N/A			

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Boiler unit V	Particulates	32.8 mg/m³	50 mg/m³	5-20 mg/m³	Yes	No	Continuous monitoring – QAL 2 Certified	30 min average values (Permit indicates 48h average and monthly average values.) (BREF indicates daily averages.) [3]	101.325kPa
	SO_2	909.8 mg/m³	400 mg/m³	20-200 mg/m³	Yes	No			O_2 5.5-7.5% (measured)
	NO_x	236.2 mg/m³	500 mg/m³	50-200 mg/m³	Yes	No			273K
	Cd	No data	10 mg/m³	No BAT-AEL	N/A	N/A			
	Hg	No data	0.3 mg/m³	>75% reduction	N/A	N/A			
	Smoke	No data	Ringelmann 1	N/A	N/A	N/A			

Note 1: Emission limit of 150mg/m3 in force until September 2007 therefore permit was compliant despite several exceedances of 150mg/m3.

Note 2: Periodic monitoring data was not available at the time of assessment as the continuous emissions monitoring equipment was installed and operational in 2008. On the basis of the information provided, the mass emissions for the period Jan-Dec 2007 were reported as:

SO2 - 6,790 tonnes (unit I), 8,410 tonnes (unit II), 8,080 tonnes (unit III), 5,230 tonnes (unit IV).

NOx – 5,450 tonnes (unit I), 5,140 tonnes (unit II), 5,190 tonnes (unit III), 3,490 tonnes (unit IV – shutdown Sept 07 onwards for maintenance).

An assessment of 2008 data would allow a more up-to-date comparison of permit conditions with actual performance. However, 2008 data was not made available in detail for this assessment (only a snap-shot was provided during the site visit).

There was some confusion at the meeting as to whether the NERP should over-ride the ELVs set in the permit and this issue could not be fully resolved for the purposes of this assessment.

3. Whilst there are some differences in averaging periods between the permit and the BREF, the full data-sets are made available to the Competent Authority during the annual submission of environmental reports

Emissions to water

Liquid process wastewaters	pH	8.07 (annual av.)	6.5-8.5	N/A	Yes	N/A	Continuous monitoring using composite samples over a 24 hr period	Daily average values Averaging time same as permit (which states on-line continuous monitoring	Not given
	Flow	819 m³/hr (annual av.)	2000 m³/hr	N/A	Yes	N/A			
	Temperature	No data	25°C	N/A	Unknown	Unknown	Periodic Monitoring 3		

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	Suspended Solids	No data	30 mg/l	5-30 mg/l	Unknown	Unknown	spot samples inside 24 hr period (2 hrs apart)	over 24 hr) and BREF	
	Total oil	No data	30 mg/l	<30 mg/l	Unknown	Unknown			
	Heavy metals and minerals (P,N,F,B)	P <0.025 mg/l F 0.29 mg/l Hg <0.01 mg/l Cd <0.02 mg/l	No limits	Hg: 0.01-0.02 mg/l Cd: <0.05 mg/l F: 1-30 mg/l N: <50 mg/l	N/A	Yes			
Emissions to land									
Not applicable.									

3.3.5 Case study 2 – Italy

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/IT/22. The information in this table is based on the detailed assessment for this installation in Appendix B2. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	At the time of the assessment (and permit review), the installation was not yet operating; however this installation was the only coal-fired large combustion plant (LCP) with an IPPC permit in Italy. It was therefore agreed that this installation should be included in the study given that it fulfils the criteria set for this project; it highlights the basis for the permit as compared to BAT for this sector in Italy; and also includes considerations on expected changes to emissions as a result of fuel switching from heavy fuel oil to coal (albeit without monitoring data for use of coal). The installation is a coal-fired power station that will generate power via pulverised coal combustion. The installation is permitted under Section 1.1 of Annex I of Directive 2008/1/EC, for combustion activities with a rated thermal input > 50MW. The installation is made up of three separate units, each of 660MWe, connected to one stack. Abatement fitted to the power plant includes flue gas desulphurisation (FGD) with limestone injection to abate SO_x emissions, selective catalytic reduction (SCR) to abate NO_x emissions and fabric filters to abate particulates and heavy metals. Ammonia required for SCR is produced on-site from urea. Gypsum generated from the FGD process, and fly ash generated from combustion, will be sold as by-products to the cement industry. Industrial water used within the process will be generated from the desalination (reverse osmosis) of seawater. Wastewater generated predominantly from the FGD plant will be treated within an on-site wastewater treatment plant, for removal of heavy metals. Recycling of wastewater is to be maximised within the process. Cooling water will be collected and discharged back into the sea. All coal will be transported via fully enclosed conveyors and stored in enclosed storage bunkers to minimise dust emissions.
Type of permit / issue date	This was a new permit for a new process and was issued in December 2003. Under the LCP Directive the plant falls under the 'new new' definition. Due to the existing national legislation in force within Italy at the time (D/Leg 59/2002), this permit was issued by the Ministry of Economic Development as a "unitary" permit, i.e. one which pulled together all previous permits issued under various legislation, including for water, air and waste. This specific decree set out provision for the permit required by Directive 96/61/EC (now Directive 2008/1/EC) to be incorporated within the "unitary" permit, until the Directive was transposed into national legislation. (The Directive was transposed into national legislation in 2005.)
Basis of BAT determination	At the time of the application submission and permit issue the Large Combustion Plant BREF document was available in draft. The final version of this document was not issued until 2006. BAT, as applied within this installation, was based on the detailed knowledge and experience of the organisation involved (they operate various other large combustion installations), and liaison with similar organisations around the world. It is understood that representatives of the company contributed to the development of the BREF document. Following application submission, the competent authority set out requirements, within a formal request for information, for an assessment to be made of the proposed abatement equipment in line with BAT as included in the draft BREF document. In relation to emissions to sea, ELVs are set out in national legislation and as such constitute GBRs.

Permit application	
Requirements of Article 6	The permit application appeared to address all Article 6 requirements. The operator was required to provide further information through a formal request from the Ministry of the Environment following liaison with other competent authorities. This request required the operator to provide information on the environmental impact of both the construction and operational phases, as required by the EIA and IPPC Directives respectively. Although the competent authority issued a detailed request for further information to be supplied by the operator, this was deemed by the competent authority to be a good quality application.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit for this installation incorporates requirements of the EIA and IPPC Directives and includes measures to be taken by the operator designed to ensure environmental impact is prevented/reduced during construction, operation and subsequent closure of the installation. The permit describes measures to be implemented to address pollution prevention relating to fugitive and point source emissions, waste management, energy and prevention of fire. To ensure no significant pollution is caused, the permit sets out ELVs for emissions to air.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** The ELVs, which have been set in relation to emissions from air, are included in the table below. **Water:** The ELVs for emissions to water are set in line with national legislation (D.Legs 152/06) and as such constitute GBRs. These are set out in the monitoring plan developed by the operator and are included in the table below. **Land:** No ELVs or equivalent parameters or technical measures have been set in relation to emissions to land. **Protection of soil and groundwater:** No ELVs or equivalent parameters or technical measures have been set in relation to the protection of soil and groundwater. **Transboundary considerations** The permit does not contain information on transboundary considerations as the competent authority deemed the installation to be too far from the nearest country. **Further equivalent technical parameters/measures** have been set for: Not applicable.

Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** The draft LCP BREF document was taken into consideration in the setting of the permit ELVs for NO_x, particulates and SO_x. The permit ELV for particulate emissions (15 mg/Nm^3) has been set at a level lower than the limit in the Directive on Large Combustion Plants (50 mg/Nm^3 for existing plant and 30 mg/Nm^3 for new plant) and Italian law. It is slightly higher than the BREF BAT-AEL range of (5-10 mg/Nm^3 for new plants with a >300MW$_{th}$ capacity; however the BAT-AEL is based on a daily average compared to the ELV in the permit, which is based on an hourly average. Due to the nature of the techniques being employed at the installation the operator expects actual performance to be within the BAT-AEL range. The ELVs for emissions to water, as described above, are set in line with national legislation (D.Legs 152/06). The ELVs for COD and some heavy metals (nickel, lead and chromium) are higher than the BAT-AELs defined within the BREF document associated with the operation of a BAT- FGD waste water treatment plant. These are set out in the monitoring plan developed by the operator and are included in the table below. Due to the nature of the waste water treatment technology being installed the operator expects actual performance to be within the BAT-AEL range. The competent authority, within the formal request for further information, asked for clarification to be provided by the operator that abatement equipment installed within the installation is in line with BAT as specified in the draft LCP BREF document. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** There is evidence within the permit, request for further information and meeting notes from the 'Conference of Services' of a number of specific technical characteristics of the installation having been taken into consideration: ▪ Due to the building of an on-site harbour, subsequent shipment of coal and discharge from the on-site wastewater treatment plant to the sea a number of conditions have been included in the permit relating to protection of the marine environment. ▪ The permit contains a correction factor which takes into consideration wind speed and direction and which is to be applied by the operator when calculating the mass flux of total particulate emissions from the installation (as a result of both point source and fugitive releases). ▪ Particulate emissions are deemed to be the most sensitive emissions from the site; therefore the permit includes a number of conditions relating to point source and fugitive emissions of particulates from the site, including the control and independent monitoring of a number of ambient air quality monitoring points outside the installation boundary. A real time display of particulate concentration will be provided to local residents and those in neighbouring regions. During the drafting of the application there was a need for an archaeological survey to be taken into consideration, on the land and in the sea, as required by Italian law. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** There is no evidence of any such factors influencing permit conditions.
Use of relevant BREF documents in setting permit conditions?	There is no direct mention of the BREF document within the permit as, at the time of application, submission and permit issue, the Large Combustion Plant BREF document was available only in draft. However, the formal request for information from the competent authority required the operator to clarify that the abatement chosen was in line with BAT. In addition, in successive documents submitted by the competent authority, there is reference to the LCP BREF document. The competent authority reported that the BAT-AELs set within the BREF document were taken into consideration in the setting of the permit ELVs for air emissions.

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** A monitoring plan was not included within the permit; however the permit did include, as an improvement programme, a requirement for the operator to submit a monitoring plan within 6 months of permit issue. The operator has officially submitted a monitoring plan in response to the improvement programme outlined in the permit; however it is not yet formally approved and is currently being reviewed by the competent authority prior to formal acceptance. **Are the monitoring requirements sufficiently detailed?** The draft monitoring plan contains sufficient detail of parameters to be monitored at each emission point, method for analysis, uncertainty, frequency of monitoring and reporting and includes the following: ▪ Continuous monitoring of boiler stack emissions (SO_x, NO_x, particulates, oxygen, as an hourly average). ▪ Periodic monitoring of heavy metals, polycyclic aromatic hydrocarbons (PAHs), dioxins, ammonia, halogens (as HF, HCl), six monthly for the first 2 years. ▪ Monitoring of fugitive emissions. ▪ Monitoring of rainwater discharge. ▪ Monitoring of cooling water (seawater) discharge. ▪ Monitoring of treated water. ▪ Quantities of raw materials, waste, water and energy used. ▪ Monitoring of key performance indicators. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** The BREF document specifies that continuous emissions monitoring (CEMs) is the preferred method of monitoring emissions and this has been taken into consideration for this installation as described above. Monitoring specifically takes into consideration the requirements of the large combustion plant directive (LCPD). **Does the permit include information on duration in relation to monitoring requirements?** The permit does include information on duration in relation to monitoring requirements.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	The permit sets out requirements for the operator to address potential emergency situations through submission of a fire plan, according to national legislation. The competent authority reported that there is a derogation within national legislation for ELVs during start up and shut down. This is not yet defined within the permit, as the operator needs to first determine the critical line above which is standard operation and below which is regarded as start-up and shut-down operations. The operator will provide this information during commissioning of the plant.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** ELVs for releases to water and sewer are based on national legislation (see above*).* The ELVs for discharges to controlled water from this installation are based on this national legislation. Reference to this legislation is made within the permit.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The competent authority reported that there were no EQSs requiring stricter conditions than those achievable by use of BAT. However, to ensure compliance with EU and national ambient air quality limit values, there are requirements in the permit for the operator to monitor ambient air quality at a number of off-site monitoring points.

Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit itself does not contain information on period of validity or an expiry date; however this is defined within national legislation. For this particular installation the permit is valid for a period of 8 years, due to the installation being registered under EMAS. In line with national legislation, the Ministry of the Environment initiated a need for a re-examination of permits issued to power plants from 1999 until 2005, when the national IPPC legislation (D.Leg 59/2005) came into force. As this permit was originally issued in 2003, review of the permit has started. As highlighted by the Ministry of Economic Development at the end of an ad hoc procedure, the re-examination process focuses on the introduction of additional emission limits not considered in the previous issue and on the review of the monitoring programme, according to the Environmental Protection and Technical Services Agency (APAT) position.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The application and permit are available on the public register (including on the internet).

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	This installation is still in the construction phase; therefore this question is not currently relevant, as monitoring equipment has yet to be installed and the installation was not operational at the time of the site visit.
Operator's compliance with monitoring conditions	Not applicable (see above).
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	Prior to the use of coal, the installation burned heavy fuel oil to generate electricity. As a result of the fuel type and nature and size of the power plant, emissions of NO_x, SO_x, CO_2 and particulates were significantly higher than those proposed (and limited by the permit) for when the installation is burning coal. Reduction in emissions are estimated by the operator to be: ▪ CO_2 = 19% reduction ▪ SO_x = 88% reduction ▪ NO_x = 61% reduction ▪ Particulates = 88% reduction However account needs to be taken of a reduction in the number of boilers on-site from four to three, and a subsequent reduction in gross power output. In addition, the figures above also take into consideration a further 30% reduction, proposed by the operator in the emissions of the new coal-fired power plant as a result of measures to be implemented to lower mass flux emissions.
Current emissions of key pollutants	The Installation was not operational at the time the assessment was undertaken.
Assessment of Installation performance against BAT	Although the installation is not currently operational, the operator has produced (confidential) predicted monthly average emissions of SO_2, NO_x and particulates, based on knowledge and experience of the efficiency of the abatement equipment. Based on the operator's assessment, these are expected to be well within the BAT-AELs. There is a plan for these emissions to be reviewed once the first coal has been combusted. The expected emissions from the wastewater treatment plant are reported by the operator to be lower than the permit ELVs and in line with the BAT-AELs according to the industrial process being installed.

Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The operator provided a detailed site closure plan following a formal request for further information from the competent authority. The site closure plan submitted by the operator to address this requirement included details on: ▪ The steps that will be taken to demolish the plant, including underground pipework and conduits (described under Question 2 above). ▪ Identification and disposal of demolition waste. ▪ Land remediation, using materials suitable for green areas. The timescale for demolition and land remediation might be as short as 30 months from the beginning of the closure activities.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The competent authority (ARPA) will have a live link to the CEMS data and so will be able to check the emissions for compliance. The competent authority will be undertaking site inspections that will include verification of the continuous monitoring equipment. The operator is obliged to send every 6 months a report to inform the competent authorities of work progress. In addition, once the plant is operational, the operator will send through an annual report (6-monthly to start with) of performance to the competent authority for review. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** As the installation is currently not operational this question does not apply. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The operator has an EMAS-registered management system and as such has documented procedures in place for monitoring compliance and actioning any corrective/preventive actions. Real time data from continuous monitoring of the emission stacks is fed back to a central control room, where checks are kept constantly of the emissions. Any creep in emission concentration would be detected and actioned as soon as possible by the shift manager, with measures taken to ensure the ELVs are not exceeded. **Procedures used or action taken by the operator in the event of non-compliance** The operator is required to report non-compliance with the permit, and in particular exceedence of the ELVs, to the competent authority immediately.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The competent authority (ARPA) will undertake site inspections, both on a scheduled and un-scheduled basis. This may include parallel monitoring of the boiler stack emissions to ensure effectiveness of the CEMS. The monitoring plan is currently under review so information on the proposed frequency of site inspections is not currently available.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Not currently applicable as the installation is not yet operational. However, the competent authority reported that monitoring records will be made available by the competent authority to the public on request. In addition, the operator will include information on monitoring within the annual EMAS environmental report.

Key observations from this case study assessment
▪ At the time of the assessment (and permit review), the installation was not yet operating. ▪ Both the operator and the competent authorities have undertaken a detailed and thorough assessment of the emissions and potential impacts, during the application and determination of the permit. This assessment has considered the impact associated with both the construction and operational phases as required by both the EIA and IPPC Directives and has incorporated the requirements of both within one permit. ▪ While the permit does not specifically document measures to ensure operation of the installation in line with the requirements of Article 3 of the IPPC Directive, the meeting minutes of the Conference of Services and detailed request for further information demonstrate that Article 3 requirements were taken into consideration in determining the application. ▪ It is recognised by the competent authorities that the permit was initially issued before the IPPC Directive was transposed into national legislation. To address this, the Ministry of Environment has initiated a review of the existing permit in line with the national legislation. ▪ The majority of the ELVs for emissions to air are in line with the BAT-AELs. The permit ELV for particulate emissions (15 mg/Nm^3) has been set at a level lower than the limit in the Directive on Large Combustion Plants (50 mg/Nm^3 for existing plant and 30 mg/Nm^3 for new plant) and Italian law. It is slightly higher than the BREF BAT-AEL range of (5-10 mg/Nm^3 for new plants with a >300MW_{th} capacity; however the BAT-AEL is based on a daily average compared to the ELV in the permit, which is based on an hourly average. Actual performance is expected by the operator to be within the BAT-AEL range. ▪ The ELVs for emissions to water are set in line with national legislation (general binding rules). The ELVs for COD and some heavy metals (nickel, lead and chromium) are higher than the BAT-AELs defined within the BREF document associated with the operation of a BAT-FGD waste water treatment plant. These are set out in the monitoring plan developed by the operator and are included in the table below. Actual performance is expected by the operator to be within the BAT-AEL range, due to the nature of the waste water treatment technology being installed. ▪ Current performance of the installation cannot be assessed, as the installation was not yet operational when the assessment took place.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Permit ELV within BAT-AEL range?	Monitoring (permit) Method	Sampling/ measurement time	Reference Conditions
This table differs from those for other installations as the plant was not yet in operation at the time the assessment took place. Therefore, this table compares permit ELVs with the BAT-AELs.								
Emissions to air								
Each boiler stack discharge	NOx	N/A	100 mg/m^3	90-150 mg/m^3	Yes	Continuous	Hourly average (Note 1)	
	SOx	N/A	100 mg/m^3	20-150 mg/m^3	Yes	Continuous	Hourly average (Note 1)	
	PM_{10}	N/A	15 mg/m^3	5-10 mg/m^3	No	Continuous	Hourly average (Note 1)	
	NH_3	N/A	5 mg/m^3	5 mg/m^3	Yes	No data		
	PAHs	N/A	0.01 mg/m^3	No BAT-AEL	N/A	No data		
	PCDD/PCDF	N/A	0.1 mg/m^3	No BAT-AEL	N/A	No data		
	Mercury	N/A	0.05 mg/m^3	0.05 mg/m^3	Yes	No data		
	Cadmium & Thallium	N/A	0.05 mg/m^3	0.05 mg/m^3	Yes	No data		
	Heavy metals (Sb, Pb, Cr, Co, Mn, Ni, V & Sn)	N/A	0.5 mg/m^3	0.5 mg/m^3	Yes	No data		

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Permit ELV within BAT-AEL range?	Monitoring (permit) Method	Sampling/ measurement time	Reference Conditions
Notes: 1. BREF BAT-AELs for emissions to air, are based on a daily average, while the permit ELVs have been set based on an hourly average. 2. No data are available on installation performance as the installation was not operational at the time the assessment was undertaken.								
Emissions to water								
Discharge from wastewater treatment plant	pH	N/A	5.5-9.5		N/A	IRSA 2060	See note 3 (for all rows)	
	Gross solids	N/A		5-30 mg/l	N/A			
	Total suspended solids	N/A	200 mg/l		N/A	IRSA 2090-B		
	BOD_5	N/A	250 mg/l	No BAT-AEL	N/A	IRSA 5120		
	COD	N/A	500 mg/l	<150 mg/l	No	IRSA 5130		
	Al	N/A	2.0 mg/l	No BAT-AEL	N/A	IRSA 3050-A		
	Cd	N/A	0.02 mg/l	<0.05 mg/l	Yes	IRSA 3120-A		
	Cr tot	N/A	4.0 mg/l	<0.5 mg/l	No	IRSA 3150-A		
	Cr VI	N/A	0.20 mg/l	No BAT-AEL	N/A	IRSA 3150-C		
	Iron	N/A	4 mg/l	No BAT-AEL	N/A	IRSA 3160-A		

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Permit ELV within BAT-AEL range?	Monitoring (permit) Method	Sampling/ measurement time	Reference Conditions
	Manganese	N/A	4 mg/l	No BAT-AEL	N/A	IRSA 3190-A		
	Nickel	N/A	4 mg/l	<0.5 mg/l	No	IRSA 3220-A		
	Lead	N/A	0.3 mg/l	<0.1 mg/l	No	IRSA 3230-A		
	Copper	N/A	0.4 mg/l	<0.5 mg/l	Yes	IRSA 3250-A		
	Zinc	N/A	1.0 mg/l	<1 mg/l	Yes	IRSA 3320-A		
	Phosphate	N/A	10 mg/l	No BAT-AEL	N/A	IRSA 4110		
	Mercury	N/A	0.005 mg/l	<0.01-0.02 mg/l	Yes	IRSA 3200-A2		
	Arsenic	N/A	0.5 mg/l	No BAT-AEL	N/A			
	Selenium	N/A	0.03 mg/l	No BAT-AEL	N/A			
	Ammonia (NH_4)	N/A	30 mg/l	< 50 mg/l (for nitrogen compounds)	Yes	IRSA 4030-A1		
	Nitrous oxide	N/A	0.6 mg/l		Yes	IRSA 4050		
	Nitric oxide	N/A	30 mg/l		Yes	IRSA 4040-A2		
	Total hydrocarbon	N/A	10 mg/l	No BAT-AEL	N/A	IRSA 5160-B2		
	Surfactants	N/A	4 mg/l	No BAT-AEL	N/A	IRSA 5170		
	Free chlorine	N/A	1 mg/l	No BAT-AEL	N/A	IRSA 4080		
	Sulphur	N/A	2 mg/l	No BAT-AEL	N/A	IRSA 4160		
	Sulphate	N/A	1000 mg/l	1000-2000 mg/l	Yes	IRSA 4140-B		

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Permit ELV within BAT-AEL range?	Monitoring (permit)		
						Method	Sampling/ measurement time	Reference Conditions
	Chloride	N/A	1000 mg/l	No BAT-AEL	N/A	IRSA 4090-A1		
Note 3: For emissions to water, the relevant GBR specifies a 24h measurement period. The LCP BREF gives emission levels associated with the use of a BAT for FGD waste water treatment plant as a representative 24 hour composite sample.								
Emissions to land								
Not applicable.								

3.3.6 Case study 3 – Netherlands

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/NL/14. The information in this table is based on the detailed assessment for this installation in Appendix B3. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is a coal-fired power plant, comprising three units; two units both having an electric and thermal capacity of 540 MWe and 1360 MWth respectively and one unit with an electric capacity of 1100 MWe. Recently, some secondary fuels have been co-incinerated in the power plant. The installation also comprises a gas-fired combined heat and power plant, with an electric capacity of 83 MWe.
Type of permit / issue date	There are four operative permits for all the activities except for the water discharge. For waste water, the company disposes of three permits establishing the conditions for the discharge. The permits assessed have been issued over the period 2006 – 2007.
Basis of BAT determination	The following sources were used for the determinations of the BAT: • Knowledge and experience (e.g. developments elsewhere) of the competent authorities • The permit application indicating feasible ELVs as determined by the operator • The BREF for large combustion plants • Horizontal BREFs like BREF Cooling Systems, Energy Efficiency, Cross media Effects etc. • General binding rules
Permit application	
Requirements of Article 6	The application met the Article 6 requirements with the exception of the measures foreseen to return the site to a satisfactory state after cessation of the activities.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** All items of Article 3 of the Directive are covered in the 2008 modified permit.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	ELVs to air are set in the permit. The ELVs set for emissions to air are towards the most stringent of BAT-AEL range and the relevant GBRs. ELVs for discharges to water are set in a separate permit.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** The ELVs enforced in the permit are first based on BAT. If ELVs, according to GBRs like the Bva and the NeR, are more stringent than the BAT-AELs, the most stringent ELV is always imposed. ELVs in GBRs have been determined taking into account BAT, the requirements of the NEC Directive and experience of the CA and within the sector.

	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? Local environmental conditions have been considered when setting ELVs. The impact on the local environment (air quality, noise, water, etc.) has been assessed in the EIA and the outcome of the EIA has been taken into account when setting ELVs. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** No
Use of relevant BREF documents in setting permit conditions?	A comparison of the permit ELVs with the corresponding BREF document BAT-AELs show that the permit conditions appear to be consistent with the BAT-AELs for all parameters mentioned in the BREF.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Monitoring requirements for emissions to air are either specified in the permit or refer to GBRs (Bva). For ELVs to water, the operator and the CA have agreed on measurement methodology, evaluation and reporting. **Are the monitoring requirements sufficiently detailed?** Yes, the monitoring requirements are sufficiently detailed and refer to GBRs. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** Yes, although the operating conditions under which monitoring should be performed is not always specified. **Does the permit include information on duration in relation to monitoring requirements?** Yes, duration is specified in the GBRs.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Yes, there are specific conditions relating to dealing with abnormal situations. These deal with reporting to the CA on the one hand and to maximum duration of such abnormal situations on the other hand. Some of these measures are also specified in the GBRs.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes. The applicable GBRs are referred to in the permit. GBRs always apply unless a more stringent derogation is specified in the permit.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** EQS have been taken into consideration when setting ELVs to air and the potential impact on air quality has been assessed through dispersion modelling. Because of the impact on local air quality and the strict ceilings for some pollutants under the NEC Directive, ELVs for most pollutants are at least within the lowest range of BAT-AEL and are stricter than BAT-AEL for NO_x.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	No expiry date is mentioned in the permit, but the permit conditions are regularly reviewed by the CA. In some cases this review leads to a reconsideration or an update of permit conditions. The operator has to report on the (technical and economic) feasibility of further lowering the emissions every 5 years.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The application and the draft permit are subject to public participation during the permit application procedure. Permits and permit applications can be consulted on demand. **Are monitoring records made available to the public?** Monitoring records are made available to the public in the annual environmental report. Yearly loads to air and water of the largest installations in the Netherlands are put on the internet by the CA (emissieregistratie.nl).

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	Emissions of SO_2 and NOx to air are monitored continuously, while the other pollutants are spot sampled and analysed according to GBRs. All monitoring of emissions to air is performed at the stack level. Wastewater discharge is sampled daily.
Operator's compliance with monitoring conditions	The operator complies with the monitoring conditions.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	Emissions of NOx in the past were a factor of 5 higher than the current emissions. An 80% reduction of emissions has been achieved by the installation of an end-of-pipe DeNOx system, which has been imposed as a result of the review of the permit.
Current emissions of key pollutants	This information is provided within the table below, showing yearly averages for emissions to air and maximum of all spot samples analysed for emissions to water. Data shown in the table below refer to 2007 when the plant was operating with the DeNOx system in place for only part of the year, explaining why yearly average NOx concentrations are higher than the permit ELV.
Assessment of Installation performance against BAT	Based on the emissions data provided, where a comparison with BAT-AELs has been possible, emissions are within or, in some cases, below the BAT-AEL ranges. There are a number of cases (mainly for air emissions with one for water emissions) where the data provided indicate emissions greater than permit ELVs, as illustrated in the table below. However, where BAT-AELs are available, these emissions are within the BAT-AEL ranges (the permit ELVs are set below the upper end of the BAT-AEL ranges, and in some cases below the lower end of the range).
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	These measures are governed by GBRs and mainly relate to the quality of the soil. The operator has to assess soil quality before start-up of activities and after cessation of activities. In case of pollution, soil sanitation has to be performed by the operator.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** • Regular inspections • Review of the environmental report • Independent sampling and analysis • Regular meetings with the management If a warning letter from the inspection department has no result, a juridical procedure can be started (including fines for example). **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** For the non-compliance incidences detected thus far (considered by the CA to be minor), a formal enforcement letter was considered sufficient to settle the case. The CA suggested that the operator should obey warnings more quickly and the operator is reportedly starting to take a more pro-active attitude. The main issues are: NO_x emissions from the heat power plant; a requirement to make an inventory of the storage tanks; SO_2 emissions; and timing for the performances of surveys. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** • Continuous monitoring • Audits • Controlling fuel quality **Procedures used or action taken by the operator in the event of non-compliance** The operator aims to solve the non-compliance as soon as possible and communicates with the authority about the actions taken. Non-compliances are also discussed during the 3-monthly meeting between the CA and the operator.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** There are 4 inspections each year. It is unclear how inspection frequency is determined.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** The non-confidential part of the annual environmental report is publicly available.

Key observations from this case study assessment

The permit conditions are considered to be in line with the requirements of the IPPC Directive.

The basis for the BAT determination was the BREF documents and general binding rules. Both the CA and the operator indicate that general binding rules are not always in line with the BREFs. However, where general binding rules contain more stringent ELVs than the BAT-AEL, the GBR ELV is always imposed in the permit and vice versa. As a result, the enforced permit ELVs for air are situated at the lower end of the BAT-AEL range and for NO_x are stricter than BAT-AEL, which implies (according to the operator) the use of technologies mentioned in the BREF on a scale and capacity beyond the scope of those considered in the BREF document.

Where relevant, monitoring data for water suggest that emissions are compliant with permit ELVs and within or in some cases below the BAT-AEL ranges. Although the permit ELVs for air are sometimes exceeded, the monitoring results for emissions to air are within the BAT-AEL ranges for all cases where a comparison could be made.

Emissions of NO_x in the past were a factor of 5 higher than current emissions. An 80% reduction of emissions has been achieved by the installation of an end-of-pipe DeNOx system, which has been imposed as a result of the review of the permit. Emissions data available for the current study were for 2007 when the plant was operated with the DeNOx system in place for only a part of the year. This led to an exceedence of the permit ELV over this period.

Sanctions have been applied for this installation in the form of warning letters from the competent authority.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) (Note 1)	Corresponding BREF BAT-AEL (inc. units) (Note 2)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to air (data from 2007)									
Existing installation with electrostatic precipitator + DeNOx + desulphurisation	Dust	5 mg/Nm³	5 mg/Nm³ (Y) 10 mg/Nm³ (hr)	5-20 mg/Nm³ (C)	Yes	Yes	Continuous	Yearly average calculated from daily average values	6% O_2, dry
	Hg	1.6 µg/Nm³	2.9 µg/Nm³ (Y) 5 µg/Nm³ (hr)	N/A	Yes	N/A	Not Specified	Yearly average	6% O_2, dry
	SO_2	166 mg/Nm³	127 mg/Nm³ (Y) 189 mg/Nm³ (hr)	20-200 mg/Nm³ (C)	No	Yes	Continuous	Yearly average calculated from daily average values	6% O_2, dry
	NOx	158 mg/Nm³	75 mg/Nm³ (Y) 200 mg/Nm³ (hr)	90-200 mg/Nm³ (C)	No (Note 3)	Yes	Continuous	Yearly average calculated from daily average values	6% O_2, dry
	CO	24 mg/Nm³	50 mg/Nm³ (d)	30-50 mg/Nm³ (NS)	Yes	Yes	Continuous	Yearly average calculated from daily average values	6% O_2, dry
	HCl	3.6 mg/Nm³	4.4 mg/Nm³ (Y) 10 mg/Nm³ (hr)	1-10 mg/Nm³ (NS)	Yes	Yes	Continuous	Yearly average calculated from daily average values	6% O_2, dry
	Sum 9 metals	6.9 µg/Nm³	6.8 µg/Nm³ (Y) 13 µg/Nm³ (hr)	N/A	No	N/A	Periodic spot sampling	Yearly average calculated from spot sample values	6% O_2, dry

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) (Note 1)	Corresponding BREF BAT-AEL (inc. units) (Note 2)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	Cd+Tl	0.003 μg/Nm³	0.11 μg/Nm³ (Y) 0.2 μg/Nm³ (hr)	N/A	Yes	N/A	Not Specified	Yearly average	6% O_2, dry
Plant 3	Dust	4 mg/Nm³	3 mg/Nm³ (Y) 8 mg/Nm³ (D)	5-10 mg/Nm³ (C)	No	Yes	Continuous	Yearly average calculated from daily average values	6% O_2, dry
	Hg	1.6 μg/Nm³	2.4 μg/Nm³ (Y) 4.8 μg/Nm³ (hr)	N/A	Yes	N/A	Not Specified	Yearly average	6% O_2, dry
	SO_2	89 mg/Nm³	40 mg/Nm³ (Y) 60 mg/Nm³ (D)	20-150 mg/Nm³ (C)	No	Yes	Continuous	Yearly average calculated from daily average values	6% O_2, dry
	NOx	75 mg/Nm³	65 mg/Nm³ (Y) 100 mg/Nm³ (D)	90-150 mg/Nm³ (C)	No	Yes	Continuous	Yearly average calculated from daily average values	6% O_2, dry
	CO	24 mg/Nm³	50 mg/Nm³ (D)	30-50 mg/Nm³ (NS)	Yes	Yes	Continuous	Yearly average calculated from daily average values	6% O_2, dry
	HCl	3.6 mg/Nm³	3 mg/Nm³ (Y) 6 mg/Nm³ (D)	1-10 mg/Nm³ (NS)	No	Yes	Continuous	Yearly average calculated from daily average values	6% O_2, dry
	Sum 9 metals	6.9 μg/Nm³	4.8 μg/Nm³ (Y) 9.6 μg/Nm³ (8 hr)	N/A	No	N/A	Periodic spot sampling	Yearly average calculated from spot sample values	6% O_2, dry
	Cd+Tl	0.003 μg/Nm³	0.09 μg/Nm³ (Y) 0.18 μg/Nm³ (8 hr)	N/A	Yes	N/A	Not Specified	Yearly average	6% O_2, dry

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) (Note 1)	Corresponding BREF BAT-AEL (inc. units) (Note 2)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Notes:									
1. Y = yearly, D = daily; hr = hourly.									
2. N/A = not applicable; C = continuous monitoring; NS = monitoring type not specified.									
3. DeNOx has been installed during the course of 2007 so the yearly average contains monitoring results from periods before and after installation of the DeNOx system. Data were not available to specifically compare the emissions prior to and after installation of this system during this period.									
Emissions to water									
WWTP	EOX	0.1 mg/l	0.1 mg/l	NS	Yes	N/A		Average of spot samples	
	Cd	0.008 mg/l	0.003 mg/l (10 sample average)	0.05 mg/l (24 hr)	No	Yes		Average of spot sample	
		0.01 mg/l	0.03 mg/l (spot sample)	0.05 mg/l (24 hr)	Yes	Yes		Maximum	
	Hg	0.0001 mg/l	0.001 mg/l (10 sample average)	0.01-0.02 mg/l (24 hr)	Yes	Yes		Average of spot sample	
		0.0002 mg/l	0.01 mg/l (spot sample)	0.01-0.02 mg/l (24 hr)	Yes	Yes		Maximum	
	Sum As, Cr, Cu, Ni, Pb, Zn	0.401 mg/l	1-5 mg/l (spot sample)	N/A	Yes	N/A		Maximum	
	PCDD/ PCDF	0.01 ng_{TEQ}/l	1-5 ng_{TEQ}/l (spot sample)	N/A	Yes	N/A		Maximum	
Precipitation basin	EOX	0.1 mg/l	0.1 mg/l (spot sample)	N/A	Yes	N/A		Maximum	

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) (Note 1)	Corresponding BREF BAT-AEL (inc. units) (Note 2)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	Cd	0.009 mg/l	0.03 mg/l (spot sample)	N/A	Yes	N/A		Maximum	
	Hg	0.0095 mg/l	0.01 mg/l (spot sample)	N/A	Yes	N/A		Maximum	
	Sum As, Cr, Cu, Ni, Pb, Zn	0.1312 mg/l	1.5 mg/l	N/A	Yes	N/A		Maximum	

3.3.7 Case study 4 – Poland

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/PL/30. The information in this table is based on the detailed assessment for this installation in Appendix B4. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation consists of a large combustion plant with a total rated input of 1755 MW_{th} and a nominal electricity production capacity of 600 MW_e. There is a potential of supplying 93 MW_{th} of heat (hot water) to consumers. The plant consists of 5 identical blocks, each with a rated thermal input of 351 MW_{th} and a nominal electricity production capacity of 120 MW_e. The plant is a pulverised coal fired plant, fired with local brown coal. Fuel oil is only used during start up. The permit foresees limited co-firing of non-toxic, non hazardous residues (e.g. from agriculture, forestry). The amount of residues that can be co-fired is limited to 200,000 tonnes/yr. Flue gas cleaning is performed by means of electrostatic precipitators (one for each block). No other emission reduction measures have been installed so far. The plant is considered to be an existing plant under the LCP Directive.
Type of permit / issue date	The existing permit of the plant expired on 31/12/2005, so the plant needed re-permitting. The permit application was filed on 14/10/2005 and the new permit was granted on 30/12/2005. There is a separate permit for discharges to water. There are clear indications that no consultation took place between the competent authorities responsible for the issuing of both types of permits, when issuing the operating (IPPC) permit.
Basis of BAT determination	The national Polish legislation states that industrial plants should operate according to BAT. For setting ELVs, there is a general fallback on national legislation, which for certain activities (large combustion plants, waste incineration plants, etc.) is the implementation of the EU legislation. In this particular case, use has been made of the transition period granted for meeting the requirements of the LCP Directive during the accession negotiations when setting the ELVs to air. The basis for setting these ELVs is unclear and could not be clarified by either the CA or the operator. The operator is required to check BAT and to propose standards based on the BREF documents in the permit application. In case the operator deems the BAT-AEL unattainable, a motivation for derogation has to be provided to the competent authority.
Permit application	
Requirements of Article 6	The application met the Article 6 requirements with the exception of the description of the main alternatives. A description of alternatives is deemed unnecessary for existing plants.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** All items of Article 3 of the Directive are covered in the permit: pollution prevention measures, measures to make sure that no significant pollution is caused, energy efficiency measures, accident prevention measures and site closure measures.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	The permit sets concentration emission limit values to air on a unit level (not at the stack) and limit values on the total load to air from the entire installation on a yearly basis. It is unclear how ELVs to air have been determined, as concentration-based ELVs are not in line with BAT-AELs or with LCP Directive ELVs. ELVs to water are set in a separate permit, which has also been assessed.

Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** There are no indications on how the ELVs for emissions to air have been determined. As this plant has received a 2 year transition period for meeting the requirements of the Large Combustion Plant Directive (negotiated during the accession negotiations and included in the relevant accession treaty) and the validity date of the permit ends before the end of this transition period, even the LCPD ELVs have not been imposed. It is unclear how new ELVs will come into effect following the period of derogation from the LCP Directive.
	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? The fact that the installation has been granted a 2 year transition period to meet the LCPD ELV has been taken into account. The permit also requires that ambient air quality standards have to be met at the border of the terrain, thus accounting for local environmental conditions. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** The competent authority has taken into account the fact that the plant heavily relies on local sources of (high sulphur) brown coal for economical operation and that the plant is likely to close down when local brown coal stocks are exhausted within a few years. It is unclear whether this consideration is incompatible with the Directive.
Use of relevant BREF documents in setting permit conditions?	There is no indication that the BREFs have been used, but operation according to BAT is a general condition in national Polish legislation (as was mentioned by the CA and the operator).
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Monitoring methodology and frequency for emissions to air and water and for noise are accurately described in the permit. Monitoring of ambient air quality is also a permit condition. **Are the monitoring requirements sufficiently detailed?** Yes **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** Only GBRs apply to the monitoring of emissions to air and water. It is unclear whether these GBRs are in line with the BREF documents. **Does the permit include information on duration in relation to monitoring requirements?** Yes, emissions to air have to be monitored continuously, which is in line with the LCP BREF.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Yes. ELVs to air do not apply during start-up and shutdown. In case of cooling tower failure, cooling water discharge is limited. Emergency procedures contain various chapters on environmental protection in case of emergency situations or breakdowns.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes. The national legislation implementing the LCP Directive would typically apply to this type of installation in Poland which can be considered to be a GBR. However, the ELVs from this national legislation are not reflected in the permit for this installation as described above. Monitoring requirements are also largely governed by GBRs.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** National legislation obliges the use of BAT. In case the application of BAT does not allow the EQS to be met in the vicinity of the plant, then stricter technical standards than BAT have to be applied (as required under the IPPC Directive). Monitoring data revealed that ambient air quality standards in the vicinity of the plant are not exceeded, so no stricter conditions were required.

Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit has to be reconsidered in 2015, which is the validity data of the existing permit. In case of major adjustments of the existing plant or major changes to European or environmental legislation, the permit will be reconsidered earlier than 2015.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The permit application was accessible to the public in the main office of the competent authority for a period of 7 days. It is unclear whether the permit application is still available to the public. The permit itself is available from the CA upon request. **Are monitoring records made available to the public?** Monitoring records from inspection authorities are made available to the public upon request.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The plant already had a continuous monitoring system for emissions of SO2, NOx and dust to air in place before the renewed permit was issued. This continuous monitoring system, however, is still not functioning in a reliable way. The company currently operates a system of discontinuous monitoring (spot samples), performed by a daughter company, in combination with regular checks by an independent company. This modus operandi has been agreed upon with the competent authority. The plant also operates continuous ambient air quality monitoring stations in the immediate vicinity of the plant. Discharges to wastewater are regularly monitored by an independent company.
Operator's compliance with monitoring conditions	According to the operator, all monitoring is performed according to permit conditions and national GBR, although the continuous monitoring system is not functioning properly.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	According to the competent authorities and the operator, modernisations in the mid 1990s have led to a significant decrease of downtime and environmental impact and a significant increase of energy efficiency. No data have been provided on the plants' performance prior to implementation of the IPPC permit.
Current emissions of key pollutants	This information is provided within the table below. Annual loads are for the year 2007. Concentration values show averages and range of spot sampling results over 2007 and 2008.
Assessment of Installation performance against BAT	The plant currently fails to (continuously) meet the more stringent permit ELVs for dust and for SO_2 (individual samples) which are significantly higher than the BAT-AELs and the LCPD ELVs. These more stringent permit ELVs have become effective from 1/1/2008 onward. The water discharge of the plant meets the permit ELVs, which for most pollutants are in line with the BAT-AELs.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The following measures are set out in the permit: • Waste generated during dismantling has to be reused or recycled to a maximum extend • Mixing of waste streams has to be avoided • Exposure of the environment during dismantling has to be avoided • Obligatory soil sanitation in case of soil pollution

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** 1 yearly inspection on site with a total duration of 2-3 days for each environmental theme and a total duration of about 2-3 months. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** Most minor non-compliances are settled after a formal enforcement letter by the CA. In some cases environmental inspectors have raised fines against operators responsible for non-compliances. There are no indications that the CA has taken action against the breach of permit conditions for emissions to air for this installation since 1/1/2008. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The operator relies on the monitoring results of emissions to air and water and the monitoring of ambient air and noise quality to check compliance with permit conditions. Operational procedures all have issues related to environmental protection and operators receive regular training on all issues. The operator states to be examining various options to ensure compliance with the stricter ELVs to air, applicable since 1/1/2008, and to have the continuous monitoring system operating properly. **Procedures used or action taken by the operator in the event of non-compliance** Operating and quality procedures foresee specific actions for dealing with non-compliance issues. For other issues, e.g. exceedance of PM ELVs, possible technical and operational measures are being assessed and will be implemented when feasible. The Competent Authorities are being kept informed on the status of ongoing assessments.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** There is 1 yearly inspection that lasts 2 – 3 months. All environmental issues are considered during this inspection.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Monitoring records from inspection authorities are made available to the public upon request. It is unclear whether compliance audits are available to the public.
Key observations from this case study assessment	
There has been no consideration of alternatives in the permit application as the consideration of alternatives is not required for existing plants under national legislation. The permit application itself was very complete and of a high quality. Although no EIA was required according to national legislation, the permit application contained all information which is normally supplied in an EIA. The basis of setting the ELVs to air is unknown. The ELVs for emissions to air are said by the competent authority to be set in line with national legislation, which normally would be the transposition of the LCP Directive. As the plant under consideration has been granted a transition period to meet the requirements of the LCP Directive and the permit expires before the end of this transition period, ELVs for emissions to air are also not in line with the requirements of the LCPD, nor with BAT-AEL. There are clear indications that there was a lack of consultation between the Competent Authority for wastewater discharges and the Competent Authority for permitting the other issues during the permitting procedure. The continuous monitoring system was not functioning properly at the time of the site visit and the operator has reverted to regular spot sampling for the follow-up of the emissions. This has been discussed with the competent authorities and an upgrading of the continuous monitoring system is being considered. The plant fails to (continuously) meet the more stringent ELV for PM emissions to air that has been in force since the start of 2008. Some spot samples on some units also exceed the more stringent ELV for SO_2 that has been in force since the same time. Options to resolve these exceedances are currently under consideration. The water discharge of the plant meets the permit ELVs, which for most pollutants are in line with the BAT-AELs, based on the monitoring data provided. The operator has to report frequently on the emissions of the installation to various Competent Authorities and the Competent Authorities undertake regular inspections.	

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods (Significant further detail is provided in the detailed assessment in Appendix B4)

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Plant (2007)	SO_2	6,208 tonnes/yr	45,680 tonnes/yr	N/A	Yes	N/A	No data	No data	No data
	NOx (as NO_2)	3,213 tonnes/yr	9,136 tonnes/yr	N/A	Yes	N/A	No data	No data	No data
	Dust	3,384 tonnes/yr	4,111 tonnes/yr	N/A	Yes	N/A	No data	No data	No data
Unit 1 (01/2008 – 06/2008)	SO_2	802 mg/Nm³ (2)* (591 – 1012)**	996 mg/Nm³ (Y)	20-200 mg/Nm³	Yes	No	No data	Spot samples	No data
	NOx (as NO_2)	414 mg/Nm³ (2)* (349 - 478)**	500 mg/Nm³ (Y)	50 – 200 mg/Nm³	Yes	No (but note split view)	No data	Spot samples	No data
	Dust	112 mg/Nm³ (1)*	100 mg/Nm³ (Y)	5 – 20 mg/Nm³	No	No	No data	Spot samples	No data

* Average (# of samples)

** (Min – Max)

The permit specifies continuous monitoring for NO_x, SO_2 and dust emissions, as set out in the LCP BREF and the LCP Directive. No data were made available on the averaging periods applicable for the monitoring data provided. The BREF suggests a daily average value for these pollutants. As detailed in the text above, spot samples rather than continuous monitoring were taken over the period for which monitoring data were provided (rather than the results of continuous emissions monitoring). This has issues for the comparability of the above data. Further data for the other Units (2, 3, 4 and 5) and for the year 2007 were also made available and are presented in Appendix B4. These are not repeated here as the picture presented is similar and these are also based on spot samples rather than continuous monitoring data (the conclusions regarding compliance with permit ELVs and BAT-AELs are similar for these other data).

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to water									
	COD	29.66 mg/l	125 mg/l	150 mg/l	Yes	Yes	No data	No data	No data
	SS	7.1 mg/l	35 mg/l	5 – 30 mg/l	Yes	Yes	No data	No data	No data
	Total N	6.84 mg/l	30 mg/l	50 mg/l	Yes	Yes	No data	No data	No data
	Sulphate	98.7 mg/l	500 mg/l	1000 – 2000 mg/l	Yes	Yes	No data	No data	No data
	Ni	0.0026 mg/l	0.5 mg/l	0.5 mg/l	Yes	Yes	No data	No data	No data
	Zn	0.027 mg/l	2 mg/l	1 mg/l	Yes	Yes	No data	No data	No data
Emissions to land									
Not applicable									

3.3.8 Case study 5 – Slovakia

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/SK/15. The information in this table is based on the detailed assessment for this installation in Appendix B5. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is a coal fired large combustion plant falling under Annex 1 Category 1.1 '*combustion activities with a rated thermal input exceeding 50MW*' of the IPPC Directive. The installation has rated thermal input of 1,614 MW. The installation operates two primary energy generation blocks: 1/ ENO.A: Pulverised lignite-fired boilers K1 and K2 (2 x 94MWth input) operational since 1954/55; Fluidised bed boiler FK1 (1 x 110MWth input) operational since 1996. The coal-fired boilers K1 and K2 operate 2-column electrostatic precipitators for dust abatement (one unit serving two boilers); the fluidised bed boiler FK1 operates a 3-column electrostatic precipitator for dust abatement, a dry SO_2 scrubber and primary de-NO_x technology to reduce nitrogen oxides emissions. Discharges to air from all three ENO.A boilers (together with the boilers B3 and B4 from the ENO.B block) are via one multi-flue 300m high stack. 2/ ENO.B: Pulverised lignite-fired boilers Block 1 and Block 2 (2 x 316MWth input) operational since 1964 and two pulverised lignite-fire boilers Block 3 and Block 4 (2 x 342MWth input) operational since 1976. Block 1 and 2 boilers were extensively upgraded in 1992/94 and operate 4-column electrostatic precipitators for dust abatement, wet flue gas desulphurisation scrubbing (FGD) and Boiler 2 operates primary measures to reduce NO_x emissions, including a temperature control system. Emissions from Block 1 and 2 boilers are discharged to air through a common 150m stack. Block 3 and 4 boilers both operate 3-column 'electrostatic precipitators to reduce dust emissions; no further abatement equipment is installed. The emissions from Block 3 and 4 boilers are discharged in separate flues through a common 300m stack (which is also used for discharging the waste gases from the 3 boilers of the ENO.A block),. The installation operates on pulverised lignite coal sourced from mining sites close to the installation. The permit details the source, quantity and characteristics of the coal materials. This information shows that 5 sources are utilised, the sulphur content varies between 0.9% - 2.1%, the energy capacity between 9.5 – 11.3 MJ/kg, the ash content between 15.7% and 36.9% and the arsenic content between 50 and 1400 mg/t. The installation operates its own waste water treatment works (within the scope of the integrated IPPC permit) and consigns part of its solid waste to an on site landfill that falls outside the scope of the main integrated permit and is covered separately by a different permit (and not dealt with in this assessment).
Type of permit / issue date	The permit was made for an existing installation under transitional arrangements. The permit application was received in August 2006 and the permit issued on 30th May 2007. The permit came into force on 19th July 2007 and has since been amended on 5 subsequent occasions to account for improvements and changes in the installation. **It is important to note that the permit has been issued on the basis that the plant has received derogation from Article 5(1) of the IPPC Directive until 31.12.2011 under the Accession Treaty.** This effectively means that the competent authority has been derogated from the requirements for granting of IPPC permits that meet all the Directive's requirements for existing installations by October 2007 – this derogation applies for the purposes of Article 3(1)(a) – application of BAT. All other provisions remain valid e.g. 'no significant pollution is caused'. Some units are also "opted-out" under the LCP Directive and therefore have been subject to limited operational hours. It should be noted that in the Commission's view it is not possible to opt-out individual units from combustion plants under the LCP Directive.

Basis of BAT determination	The competent authority highlighted that the primary information used in the assessment of BAT during permit determination is Paragraph 5 and Annex 3 of the National Integrated Pollution Prevention Law 245/2003. This sets out the basic steps and rules that a competent authority should follow in assessing BAT and developing conditions to ensure it is used by the operator to minimise pollution. For this permit, the competent authority also noted that the following sources of information were used during determination of BAT: ▪ LCP BREF document; ▪ Slovak Environmental (Component) Laws on air, water and land protection; ▪ General Binding Rules for setting of pollutant ELVs and monitoring requirements
Permit application	
Requirements of Article 6	An assessment of the operator's application shows that it contained all the key elements required by Article 6 of the IPPC Directive. The checks made by the competent authority upon receipt of the application required only minor additional information to be supplied.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** An assessment of the permit indicates that it contains a series of conditions that seek to ensure that the installation is operated in a manner that meets the requirements of Article 3. The competent authority made it apparent that the key elements required to determine an IPPC permit are clearly laid out in the national laws (within Annex 3 of the IPPC Act and Component Laws (GBRs) on air, water and waste). The Ministry of Environment has developed a permit application template that guides operators to produce applications that contain the correct information in order to facilitate determination.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** The permit contains ELVs related to air emissions for the following: ENO.A boiler FK1, ENO.B Block 1 and 2 boilers. No other air emission limits are placed in the permit. This has been explained by the fact that the installation operators requested an opt-out from the requirements of the Large Combustion Plant Directive ELVs on boilers ENO.A (K1 and K2) and ENO.B (Blocks 3 and 4). The permit effectively limits the combined maximum operational hours for these named boilers between 1.1.2008 and 31.12.2015 to 20,000 operating hours (total for all boilers). It is noted that such an opt out for part of a combustion plant (common stack definition) is not in line with the Commission's interpretation of the LCP Directive. It is also noted that the exemption from the ELVs of the LCP Directive for opted out plants is without prejudice to the requirements of the IPPC Directive and the Air Quality Directive (cf. article 4(4) of the LCP Directive). **Water:** ELVs have been set in the permit for the discharges from the wastewater treatment works, including concentration limits, mass daily limits and annual limits for key pollutants, including BOD, COD, AOX, hydrocarbons, SS). The permit also contains volumetric limit values for discharges of effluent from the treatment works of maximum (Q_{max}) 155 litres per second and a daily average (Q_{av}) of 101.5 litres per second. **Protection of soil and groundwater** The permit does not contain any ELVs relating specifically to protection of soil and groundwater but does contain general technical operating conditions to ensure protection from pollution. **Waste** The permit details the following limits on consignment of waste from the installation: ▪ specified hazardous and non-hazardous wastes to a maximum of 14,238 tonnes/year ▪ specified hazardous wastes to a maximum of 150 tonnes/year (forming a fraction of the 14,238t in the previous bullet point). **Transboundary considerations** The permit states in Section 2.G that there are no transboundary conditions required. It is understood

	from discussions with the competent authority that transboundary considerations were taken into account in setting permit conditions and that there were in accordance with Article 18 of the IPPC Directive. No further evidence of this was provided although the permit determination notes do state that such transboundary considerations were made. **Further equivalent technical parameters/measures have been set for:** The permit sets a number of technical operating conditions that require the operator to ensure correct functioning and availability of abatement equipment.. This is particularly relevant for the specific pieces of abatement equipment described within the permit and provision of measures to ensure correct and accurate operation.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** Many of the conditions contained within the permit are based on BAT and, where it is evident that BAT is not being reached/applied, improvement conditions with specific dates (running from December 2007 through to December 2009) for implementation are contained within the permit that require the operator to take such measures. However, no emission limit values are included within the permit for the emission points of units which are "opted out" under the LCPD. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** There was evidence of the installation's technical characteristics, geographical location and local environmental conditions being taken into account in setting permit conditions. It was evident that the technical characteristics (e.g. limited operational lifespan) of certain boilers were considered in determining whether they should be opted-out of the LCPD. This consideration has led to the decision by the CA not to set ELVs in the permit for certain units. The Slovak Hydro-Meteorological Institute (SHMI) assessed local environmental air quality in light of information submitted by the operator as part of the application process. This assessment is understood to have concluded that (based on evidence gathered from a local air quality monitoring network, the Operator's community monitoring station and measured point source values), that maximum predicted emission concentrations are not anticipated to cause a breach of local or Community-wide environmental air quality standards. . **Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?** None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** The fact that no ELVs have been set for units which are opted out of the LCP Directive (cf article 4(4) of the LCPD "without prejudice to IPPCD") might be interpreted as such; however, the plant is subject to a derogation for applying BAT due to the derogation under the Accession Treaty from Article 5(1) IPPCD. The operator's response was that their present economic circumstances restrict their ability to apply widespread use of FGD technologies on all boilers. The derogation from BAT based emission limits (as allowed under the Accession Treaty for Slovakia) enables the company to stage investments and prioritise capital expenditure on priority areas such as waste waster treatment plant upgrades. In response to a question to the operator and competent authority asking for further explanation as to why only periodic monitoring is required for boiler K2, the reply (which was supported by the competent authority) was that as there was no emission limit on this boiler, the installation of continuous monitoring was not cost-effective and the national regulation on air pollution allowed for periodic monitoring.
Use of relevant BREF documents in setting permit conditions?	The operator reported that the application contained information on assessment of techniques and technologies that were based to a certain degree on information provided within the LCP BREF document. The competent authority indicated that there is no national Slovakian guidance nor has the information within the BREF been translated directly or transposed into national laws. The competent authority responded that, for certain aspects, the BREF document was referred to in determining the permit conditions. Further elaboration on this point was not made during the interview.

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains a number of conditions that require the operator to monitor emissions, waste arisings, raw materials, water and energy use and operational parameters. Tables contained within the permit detail the air and water emission points to and pollutants to be monitored, frequency of monitoring and monitoring methods (but not standards) that are applicable (further information is presented in the table at the end of this case study). The permit references the requirement to comply with General Binding Rule 391/2003 that requires the operator to submit the results of monitoring conducted to the relevant competent authority (which may not in all cases be the IPPC competent authority that participated in the interview). **Are the monitoring requirements sufficiently detailed?** The monitoring requirements of the permit are very detailed and supported by General Binding Rules that require the operator to report on various parameters at defined frequencies. Conditions require monitoring of emissions to air, water and land plus monitoring conditions on waste arisings and disposal, energy use, sewage system integrity, site condition and operational status of plant and monitoring equipment (including calibration). Measurement points are specified within the permit to ensure accurate monitoring and all monitoring equipment (including continuous monitors) must be checked annually by a Ministry of Environment-approved certified contractor. **Do the monitoring requirements take into account the details contained within the BREF documents?** There was no evidence seen in the assessment that the requirements for monitoring as specified within the permit were derived directly from the LCP BREF document. The competent authority stated that national monitoring requirements are derived from the requirements of EU legislation. Many of the monitoring requirements come from the Slovakian 'Component Laws' and have been integrated as formal requirements through referencing within the IPPC Law 245/2003. The permit requirements are provision of continuous monitoring for all air emission points (in line with the requirements of the LCP BREF and the LCP Directive) with the exception of Boiler ENO A K.2. Further detail on monitoring is available within Appendix B5. **Does the permit include information on duration in relation to monitoring requirements?** Where the use of continuous monitoring is not required (wastewater emissions), the permit includes duration in relation to monitoring (e.g. minimum 8 hour composite sampling for water emissions monitoring). The permit specifies continuous monitoring with daily averages. Concerning the periodic emission monitoring requirement for the K2 boiler (ENO.A), the permit does not specify the duration
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Conditions in Section H of the permit relate specifically to pollution prevention measures aimed at control of significant pollution that could foreseeably be released during an incident, accident or plant failure.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes, where conditions are placed in the permit that refer to the requirements to comply with General Binding Rules, the GBR reference is clearly given in each condition. GBRs are discussed elsewhere in this assessment and in more depth in the detailed assessment.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The competent authority stated that the limits given in the permit are set out within the Component Laws and, as such, require an assessment of the emissions from the installation having regard to air quality standards. Based on the response from the competent authority, there are no relevant EQSs (either national or Community-level EQSs) that required stricter conditions that those achievable through the use of BAT
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	IPPC permits are valid for a maximum period of 8 years from issue date and permissions related to water emissions are valid for only 3 years, after which time the operator must re-apply to the competent authority. During the interview, the competent authority stated that the permit is a live document and, since issue, has been revised 5 times in order to take account of the construction activities and changes that have been completed as part of permit condition improvements. It was not clear how the permit would be changed once the period of derogation from the IPPC Directive has lapsed.

Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The permit application was available on the website of the competent authority during the determination of the permit (21.11.2006 to 02.01.2007) to enable members of the public to read and comment upon it. This consultation period is 40 days as required by national legislation. In addition, local community notice boards were used to post information regarding the application and subsequent decisions in the permit for those communities that could be reasonably foreseen to potentially be affected by the operation of the installation and/or its emissions. The permit is available on the website of the Slovak Environmental Inspectorate. **Are monitoring records made available to the public?** Monitoring records are available on the website of the Slovak Environmental Inspectorate (http://www.sizp.sk/) and the operator publishes all records on monitoring on formal notice boards at the front of the installation. The general public have the right to ask the operator for results of monitoring.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The operator currently employs continuous emissions monitoring for NO_x, SO_2, CO and particulates on all air emission point sources (at flue level) with the exception of boiler K2, which is monitored every 6 months for NO_x, SO_2 and particulates and three times per year for CO. All continuous monitoring must be undertaken in accordance with the standards laid out within specific component (air, water, waste) legislation. All periodic monitoring and checking/calibration of automatic monitoring system (AMS) must be conducted by an external organisation that is accredited by the Ministry of Environment and certified. The AMS is required to be serviced and operationally checked at least once per annum. Monitoring of water emissions is required on a monthly basis using 8-hour composite sampling for BOD, COD, pH, SS, DS, Cl_2 and AOX. Appropriate techniques that must be followed by the operator in monitoring water discharge parameters are specified within the permit. <u>Other monitoring</u> Monitoring of solid waste discharges and disposal is required and reported on a monthly basis. Energy consumption is monitored. The ground condition of the site is monitored every two years and a visual inspection of the sewer system is completed each year.
Operator's compliance with monitoring conditions	Based on the responses of the competent authority and operator during the interview, it is understood that all requirements for monitoring are currently met by the operator.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	No figures for emissions prior to implementation of the IPPC permit were provided prior to the interview; however based on the responses from the operator and competent authority, the introduction of IPPC has been a strong driver for investments to improve the installation's general environmental performance, particularly with regard to impacts on surface water. An example of this was given by the operator of recent investments in the water treatment plant resulting in lower levels of discharges of suspended solids to water.
Current emissions of key pollutants	**This information is provided within the table below.** The results presented in the table below were sent by the operators following the interviews. An assessment of the submitted monitoring data against permit ELVs showed no non-compliance by the operator (taking into account permit limits do not exist for all emission points).

Assessment of Installation performance against BAT	**Current performance:** **Air** A comparison with BAT-AELs demonstrates that only the fluidised bed boiler achieves a level of emissions commensurate with BAT-AELs for all key air pollutants. For all other emissions points, ; the emissions of NO_x, SO_2 and particulates are all above BAT-AELs and only the emissions of CO are within the BAT-AEL ranges. The key environmental priorities for bringing the plant up to BAT standards are emissions of SO_2 and NO_x, particularly from the boilers that have not been subject to retrofitted abatement (K1, K2 and ENO B blocks 3 and 4). It was clear from discussions that the operator is likely to operate the plants in accordance with their restricted hours limit with a view to potential new build rather than retrofit of the old boiler units. **Water** The current performance is well within the BAT-AELs for all pollutants covered by the LCP BREF.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The permit conditions require the operator to develop a site closure plan and submit it to the competent authority no later than two months prior to predicted closure. The competent authority is obliged to review the plan and assess its suitability in providing protection to the environment during and following closure and decommissioning. There is currently no closure plan developed as the operator does not intend a definitive cessation of operations on the site in the forthcoming years. It was not made clear as to whether the operator will seek to upgrade the existing opted-out plant or to demolish and re-build.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the competent authority for ensuring compliance:** The competent authority reviews the results of monthly monitoring data that is submitted to them in accordance with the schedule given in the permit. The operator is required to produce an annual compliance report that details how they comply with permit conditions and improvement conditions that have dates and deadlines set upon them. This report is reviewed by the competent authority and followed up if required. Other competent authorities (air, water, waste) are required to review monitoring data submitted to them in accordance with national GBRs. This data is not usually reviewed by the Inspectorate other than in summary format. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** The competent authority stated that there has been no formal breach of compliance with the permit conditions at the installation and therefore no action has been required. Paragraph 8.24 of the IPPC Act 245/2003 determines the measures that the competent authority must take in the event of IPPC permit compliance breaches. These powers include notification of measures that the operator must take to remediate or rectify the non-compliance and enforcement measures such as forced shut-down, fines and prosecution in a court of law. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The operator utilises continuous monitoring to ensure compliance and to analyse trends in emissions data. Operational 'prescriptions' are part of the plant operating procedures and these prescribe actions that must be taken to ensure compliance. An IPPC training plan is in place for all staff and centralised control-room technicians hold key information on compliance parameters such as limit values. **Procedures used or action taken by the operator in the event of non-compliance** The operator has a specific procedure to follow in the event of a breach of permit conditions – this forms part of the operational 'prescriptions'. The operator is also legally bound by national legislation to report any breach of compliance to the competent authority.

Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The competent authority undertakes inspections on-site. The inspections are typically focused on investigation of progress and compliance with conditions that require implementation of measures by certain prescribed dates. One inspection has been undertaken in the past 12 months and the operator indicated that they offer all assistance necessary during and following on-site inspections (comment from the competent authority on this aspect was not received).
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Monitoring records (summary only) are available on the website of the Slovak Environmental Inspectorate (http://www.sizp.sk/) and the operator publishes all records on monitoring on formal notice boards at the front of the installation. The general public have the right to ask the operator for results of monitoring. It is understood from the responses given that the results of inspections and audits are not routinely made available to the public nor placed on the public register, although such records can be accessed upon request providing there is a suitable justification and no conflicting commercial confidentiality issues.

Key observations from this case study assessment

- This plant is in a particular position as it has received a derogation from Article 5(1) of Directive 2008/1/EC until 31.12.2011 (under Slovakia's Accession Treaty). This means, inter alia, that Articles 9(3) and 9(4) requiring the installation to be operated in accordance with emission limit values based on BAT are not applicable at the present time.
- Some units of the combustion plant are "opted-out" under article 4(4) of the LCP Directive as they will not operate for more than 20,000 hours between 1 January 2008 and 31 December 2015. However, according to article 4(4) of the LCP Directive, the "opt out" provisions apply without prejudice to the IPPC Directive. Also, in the view of the Commission, it is not possible to "opt out" a part of the combustion plant under that article.
- The abovementioned elements have been utilised by the competent authorities to issue an IPPC permit that does not contain BAT-based emission limit values for key air pollutants for some of the combustion units.
- ELVs set in the permit are higher than BAT-AELs and emissions of key pollutants (NOx, SO2 and particulates) are all above BAT-AELs. The SO_2 emissions from the LCP boilers that are opted-out and not fitted with FGD technology are considerably higher than BAT-AELs.
- Monitoring data submitted by the operator (annual averages) showed no non-compliance with the permit ELVs (where set).
- Having discussed the matter of continual plant performance upgrading during the interview with the operator and competent authority, at this present time, a clear strategy on whether large combustion plant units will be subject to retrofitting prior to the deadline of 31.12.2011 has not been determined. In the opinion of the operator, it is likely that operation of the opted-out plant will cease on 01.01.2012.
- Assessment of the other aspects of the IPPC Directive has shown that the competent authority and the operator have benefited from the introduction of IPPC and have made performance improvements to reduce water pollution and operate the installation using techniques that ensure continued environmental protection whilst ensuring high levels of energy and raw material efficiency. There has been investment in new abatement technologies (notably water treatment plant upgrades) since the introduction of the IPPC permit.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) (see note 3)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit ELV?	Actual emissions below upper end of BAT AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time (Note 4)	Reference Conditions
Emissions to air									
K01 – ENO.A Boiler FK1 (fluidised bed) (110MW)	Particulates	23.7 mg/m^3	100 mg/m^3	5-25 mg/m^3	Yes	Yes	Continuous Emissions Monitoring (see note 2)	Annual average values calculated from monthly means reported from 60 mins averages taken from Automatic Monitoring System Permit requires daily averages with 97% availability over the year. BREF indicates daily averages	Corrected to 101.325 kPa, 0°C, 6% O_2
	SO_2	336.1 mg/m^3	400 mg/m^3	100-250 mg/m^3	Yes	No			
	NO_x	118.5 mg/m^3	400 mg/m^3	100-200 mg/m^3	Yes	Yes			
	CO	9.2 mg/m^3	250 mg/m^3	100-200 mg/m^3	Yes	Yes			
K01 – ENO.A (94MW) (See note 1)	Particulates	280 mg/m^3	No limits set	5-30 mg/m^3	N/A	No	As above	As above	As above
	SO_2	9,467 mg/m^3		200-400 mg/m^3		No	As above	As above	As above
	NO_x	726 mg/m^3		90-300 mg/m^3		No	As above	As above	As above
	CO	14.5 mg/m^3		100-200 mg/m^3		Yes	As above	As above	As above

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) (see note 3)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit ELV?	Actual emissions below upper end of BAT AEL range?	Monitoring (actual) Method	Sampling/ measurement time (Note 4)	Reference Conditions
Emissions to air									
K01 – ENO.B Block 3 and 4 boilers (342 MW)	Particulates	B3: 83.6 mg/m^3 B4: 110 mg/m^3	No limits set	5-30 mg/m^3		No	As above	As above	As above
	SO_2	B3: 8220 mg/m^3 B4: 8663 mg/m^3		200-400 mg/m^3		No	As above	As above	As above
	NO_x	B3: 589 mg/m^3 B4: 460 mg/m^3		90-300 mg/m^3		No	As above	As above	As above
	CO	B3: 50.9 mg/m^3 B4: 29.4 mg/m^3		100-200 mg/m^3		Yes	As above	As above	As above
K02 – ENO.B Block 1 and 2 boilers (316MW)	Particulates	23.7 mg/m^3	50 mg/m^3	5-20 mg/m^3	Yes	No	As above	As above	As above
	SO_2	209.8 mg/m^3	400 mg/m^3	20-200 mg/m^3	Yes	No	As above	As above	As above
	NO_x	309.4 mg/m^3	500 mg/m^3	50-200 mg/m^3	Yes	No	As above	As above	As above
	CO	38.4 mg/m^3	250 mg/m^3	100-200 mg/m^3	Yes	Yes	As above	As above	As above

Note 1: Results presented are from boiler No. 1 as boiler No. 2 is periodically monitored and results are not available for this emission point. [Separate flue but common stack].

Note 2: All emissions points are monitored continuously with the exception of boiler ENO.A K2, which is subject to periodic monitoring. Details of the specific methods used were not available.

Note 3: Details of time periods for the permit conditions/ELVs are set out in the detailed assessment Appendix B5.

Note 4: The averaging period for reported results is 60 minute averages calculated by the AMS. The permit specifies daily averages, which are also calculated on the basis of averaging the hourly results.

Table Note: In comparing the reported results of the installation to BAT-AELs, it must be noted that the plant is subject to a derogation from the requirements to implement BAT under Article 5(1) of the IPPC Directive.

Emissions to water									
Wastewater treatment plant discharge point	pH	7.9	6-9	Not given	Yes	N/A	No information has been supplied	No information has been supplied	No information has been supplied
	COD (CHSK$_{cr}$)	13.3 mg/l	30 mg/l	<150 mg/l	Yes	Yes	As above	As above	As above
	BOD (BSK$_5$)	2.1 mg/l	10 mg/l	Not given	Yes	N/A	As above	As above	As above
	Suspended Solids (NL)	10.3 mg/l	40 mg/l	5-30 mg/l	Yes	Yes	As above	As above	As above
	Dissolved Solids (RL$_{550}$°C)	351.5 mg/l	600 mg/l	Not given	Yes	N/A	As above	As above	As above
	Hydrazine	0.02 mg/l	1 mg/l	Not given	Yes	N/A	As above	As above	As above
	Non-polar extractables	0.1 mg/l	0.2 mg/l	Not given	Yes	N/A	As above	As above	As above
	Active Chlorine	0.04 mg/l	0.2 mg/l	Not given	Yes	N/A	As above	As above	As above
	AOX	0.09 mg/l	0.3 mg/l	Not given	Yes	N/A	As above	As above	As above
Emissions to land									
Not applicable.									

3.3.9 Case study 6 – Spain

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/ES/33. The information in this table is based on the detailed assessment for this installation in Appendix B6. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is a coal fired combustion plant for electrical energy production. The activities of the Installation are covered under Annex 1 (1.1) the IPPC Directive: *'Combustion installations with a rated thermal input of >50 MW'.* The IPPC permit covers the following installations and activities: ▪ Electrical energy production at the main/central combustion installation ▪ Non-hazardous waste disposal at the landfill site (the non-hazardous disposal site has not been assessed as part of this case study) The combustion installation is made up of 2 separate production units: Group 1 & Group 2. The rated thermal input (at the time of permit application) is 434 MW for Group 1 and 966 MW for Group 2. Approximately, 1% biomass is currently used; the Operator indicated that this is expected to increase to 5%. It is understood that there are 2 separate stacks, however this has not been confirmed by the Operator for this assessment. The plant is characterised as an existing plant under the LCP. The installation consists of boiler and turbine with alternator for energy production, silos for storage of ashes and waste from boiler processes, coal storage park with belts for transportation, coal Pulverisation mills for grinding and drying, Flue Gas Desulphurisation (FGD) plant (Group 2 only) (construction started 2006, expected to be operational by March 2009)., water treatment plant, waste water treatment plant (WWTP), refrigeration tower (Group 2 only). <u>Existing and planned air emissions reduction techniques/measures include:</u> • FGD plant in Group 2 for the abatement of SO_2 and particulate emissions (FGD plant to be fully operational by March 2009). The efficiency of the plant is estimated to be 92.4 – 96.6 %. • Low NO_x burners have been installed in Group 2 • Electrostatic precipitators in both Groups for the abatement of particulate emissions (existing abatement) (Group 1 efficiency 99.7%, Group 2 efficiency 99.69%) • Enclosure of certain areas that generate particulates (e.g. coal conveyors to mills); extraction in silos; irrigation • Use of national and imported coal with low sulphur content (1% content in national coal used) and auxiliary fuel oil with low sulphur content. • Advanced Boiler Automation Combustion Optimisation (ABACO) system, which allows for better control of combustion conditions in the boilers of Group 2 and optimisation of conditions for NO_x emissions reduction. • CO_2 emissions are reduced through the use of increased thermal efficiency (30-40%), use of biomass (Group 2), ABACO system, air emissions plan and internal energy efficiency measures. • The main CO emissions reduction measures used are complete combustion, facilitated through the use of the ABACO system and regular maintenance of the combustion system. <u>Existing water emission reduction techniques/measures include:</u> • Collection and treatment of surface runoff from storage areas • Oil separation wells for oil contaminated water • Wastewater treatment plant with settlement and pH neutralisation • Waste water treatment for FGD plant is in place with settlement, pH neutralisation, biological treatment

Type of permit / issue date	This is a new permit for an existing installation. The IPPC permit covers the Combustion Plant for which the permit was formally issued to the Operator on 22nd Aug 2008. Spanish legislation stipulates that an assessment is made by the Competent Authority on the Operator's compliance with all the conditions of the permit. This occurs 6 months after the permit issue. If all the conditions have been implemented or in the process of being implemented, then a 'starting authorisation' is issued to the Operator.
Basis of BAT determination	The National Emission Reduction Plan (NERP) under the LCPD and General Binding Rules (11/2003, 16/2002, 430/2004) were used to set emission limits and conditions within the permit. The BREF for Large Combustion Plants (Draft version from May 2005) was also used to assess BAT for technologies and techniques for the sector. The Competent Authority did not specify during the interview what guidance was used to determine BAT for the landfill site. There was no country-specific guidance for this sector at the time the application was made. The Operator submitted a technical justification of BAT as part of the application. These were also used by the Competent Authority in their determination of BAT. BAT was assessed by the Operator for the following: ▪ Charge, storage and handling of fuels and additives ▪ Pre-treatment of fuels ▪ Combustion process ▪ Thermal efficiency ▪ Emissions of particulates to air (both Groups) ▪ Emissions of SO_2 to air (both Groups) ▪ Emissions of NO_X to air (Group 2) ▪ Water pollution (both Groups) ▪ Waste and residues (both Groups) ▪ Environmental Management Systems (ISO14001 and EMAS accredited EMS).
Permit application	
Requirements of Article 6	An assessment of the operator's application shows that it contained all the key elements required by Article 6 of the IPPC Directive. The checks made by the competent authority upon receipt of the application required only minor additional information to be supplied.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit contains all the necessary conditions to ensure that the installation is operated in a manner that meets the requirements of Article 3.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	Annex III of the permit sets out emission limits for the control of emissions to air and land. Emission limits for water have been included in Annex IV. **Air:** The main emissions to air from the installation are SO_2, NO_X and particulates. ELVs for emissions to air have been set based on regional legislation and the requirements of the LCPD. Concentration ELVs set in the permit for emissions to air are listed in the table below. The Installation must also comply with the National Emission Reduction Plan (NERP) limits under the LCPD from the 1st January 2008 for emissions of SO_2, NO_X and particulates from Groups 1 and 2 of the installation. Annual mass emission limits or bubble limits for Spanish LCP installations under NERP have been set out in Annex 1, Table 4 of the Order PRE/77/2008. These limits apply from 2008 to 2015. There are four groups within the bubble limit including Group 1 and 2 and two other installations. The NERP annual mass emission limits values for Groups 1 and 2 are as follows: **Group 1:** ▪ SO_2 – 4820 tonnes/pa

	▪ NO_x – 1120 tonnes/pa ▪ Particulates – 310 tonnes/pa **Group 2:** ▪ SO_2 - 11,129 tonnes/pa ▪ NO_X – 1980 tonnes pa ▪ Particulates – 784 tonnes/pa **Noise:** Annex III Section 5 provides ELVs for noise from the installation, based on the limits set within national legislation (Decree 3/1995). See the table below. Further conditions have been included for the prevention and reduction of noise and vibration as a result of normal plant operation, construction activities and transport activities from the main site, the FGD plant and the landfill site. The Operator is required to have a maintenance plan for all noise reduction systems. **Water:** A separate regulating authority, the Hydrographic Confederation, has set the limits for discharges to water from the installation and discharges to water and groundwater from the landfill site, and monitors the Operator's compliance with these limits. **Land:** The permit includes pollution prevention conditions for the disposal of non-hazardous waste from the installation to the landfill site extension. The landfill is specifically for non-hazardous waste from the combustion plant. Limits have been included for annual quantities produced and disposed of at the landfill site. **Protection of soil and groundwater:** The permit contains general conditions to ensure protection of soil and groundwater from pollution at the installation and the landfill site. Annex IV of the permit sets out ELVs for emissions to groundwater from the landfill site. **Waste:** Annex III Section 6 of the permit contains limits for the maximum quantities of non-hazardous waste that can be produced at the installation and disposed of to landfill. The permit also sets out the types of hazardous waste and the maximum annual quantities that can be produced at the installation. Types of non-hazardous wastes produced include ash from combustion, residues and sludge from the desuplhurisation wastewater treatment plant. The permit includes general requirements for the management and monitoring of hazardous and non-hazardous waste produced at the installation. The permit references the GBR 10/1998 which must be complied with for dealing with residues from the installation. The installation holds a separate authorisation for production and disposal of hazardous waste. **Transboundary considerations:** The permit does not specifically contain conditions that relate to transboundary impacts and minimisation of transboundary pollution. However the NERP limits placed on the Operator in order to control emissions nationally been set for pollutants with the potential to cause transboundary impacts. **Further equivalent technical parameters/measures:** The permit sets a number of technical operating conditions that require the operator to ensure correct functioning and provision of environmental protection measures as described in the permit. This is particularly relevant for the specific pieces of abatement equipment described within the permit and provision of measures to ensure correct operation. **Energy Efficiency:** Conditions on energy efficiency have not been included in the permit.
Inclusion of permit conditions based on BAT (Article 9(4)	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** There are conditions within the permit that are clearly based on BAT. Annex III Section 5 of the permit sets out conditions for emissions to air that are considered BAT for the sector (see also the information above on the techniques in place and planned for the installation). ▪ The Operator is required to have the FGD plant for Group 2 fully commissioned and operational within 6 months of the permit issue (March 2009). The Competent Authority expects that a 95% reduction in SO_2 emissions and 80% reduction of particulate emissions are achievable. ▪ The permit requires that low NO_x burners must also be installed in Group 2 with an estimated reduction of 50-70% NO_x emissions expected. Low NO_x burners have in fact been in operation at the site since January/February 2008. ▪ Group 1 operation hours must be reduced within 6 months of permit issue to allow the installation to meet the annual mass emission limits under the NERP (see above). Separate concentration ELVs for emissions to air have been included in the permit for Groups 1 and 2. The Competent Authority stated that permit ELVs have been set based on the limits within the LCPD. This is clearly not the case for Group 1, with all concentration ELVs exceeding LCPD limits and the BAT-AEL ranges.

	Both Group 1 and 2 are included in the National Emissions Reduction Plan (NERP) under the LCPD. Separate mass emission limits (bubble limits) have been applied for Group 1 and 2 (see previous section). The Operator has decided to reduce the operating hours in Group 1 significantly (up to 80%) to operate below 1,500 hours, in order to meet NERP limits. As a consequence of this reduced operating hours, concentration ELVs set within the permit for Group 1 have not been based on BAT (Note: Group 1 is not under the 20,000 hours derogation within the LCPD). It seems that the Operator and Competent Authority have focused on Group 2 (main unit) and are not applying BAT based measures and ELVs in Group 1 because of the decision to significantly reduce its operating hours. The focus of the Operator and Competent Authority has been to meet overall NERP bubble limits. It should be noted that reduced operating hours does not guarantee reduced pollutant concentrations. Therefore, a variation to the permit is required to reflect the reduced operating hours of Group 1 and concentration limits need to be included to meet BAT, and, at a minimum, the LCPD limits (permit ELVs are currently above the LCPD limits). Two sets of concentration limits have been set for Group 2 in the permit and stricter ELVs apply once the FGD is operational (expected to be March 2009). In Group 2 (limits that apply before operation of FGD plant), the ELV for SO_2 exceeds the LCPD limit and the BAT-AEL range. A NO_x limit has been set based on a derogation in the LCPD Annex VI note 3 which states: '*Until 1st January 2018 in the case of plants that in the 12 month period ending on 1 January 2001 operated on, and continue to operate on, solid fuels whose volatile content is less than 10 %, 1,200 mgNO$_x$/Nm^3 shall apply'*. This plant was designed to burn anthracite (coal with volatile content <10%) and this design leads to higher NO_x emissions, as is also mentioned within the BREF. It can be concluded that all concentration ELVs for Group 1 and current ELVs for SO_2 emissions for Group 2 (not including limits that will apply after FGD plant) are not based on BAT and are not in line with the BAT-AELs. Furthermore, they are not in accordance with the limits in the LCPD. In Group 2 (when the FGD plant is in operation) ELVs for NO_X and particulates have clearly been set based on LCPD ELVs (even though the plant is subject to the NERP) but they exceed the BAT-AEL ranges. The SO_x limit however is based on the upper level limit within BREF and regional legislation limits for SO_2, and is well within LCPD limits. There are no ELVs in the permit for emissions of CO or heavy metals. Permit conditions have been included for the utilisation of waste and residues from the installation, giving priority to re-use and recycling. BAT is being met by sending by-products, mainly ash, for re-use in other industries. In addition, gypsum is sold to other industries for reuse. ELVs for emissions to water are within the range of the BAT-AELs with the exception of COD which is higher for some points. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** The Competent Authority confirmed that there is an air control network for the region which the installation is covered by, with 4 monitoring stations measuring local air quality. However it was not confirmed how/if this background air quality information was considered when setting permit conditions. ELVs for emissions to water were already in place prior to the permit being issued, and these were integrated into the permit. There is therefore no information on how local environmental conditions were taken into consideration when setting these limits.
	Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)? None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** None observed.
Use of relevant BREF documents in setting permit conditions?	As far as can be determined, there is no direct mention of the BREF within the permit document, however the Competent Authority confirmed that BAT was assessed using the BREF for Large Combustion Plants (Draft May 2005). The Operator also indicated that the BREF for LCPs was used to assess BAT for the IPPC application. According to the Competent Authority, there is no national Spanish IPPC guidance available, only a direct translation of the BREF for LCPs.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains a number of conditions that require the operator to monitor emissions, waste arisings

- frequency - evaluation procedure - an obligation to supply data	and operational parameters. Contained within the permit are details of the air and water emission points to be monitored together with pollutants to be monitored, frequency and the obligation to supply data to the Competent Authority. **Are the monitoring requirements sufficiently detailed?** Averaging periods were not specified for emissions to air and the permit only specifies the sources where continuous monitoring must be used, but not the methods. The permit references Order ITC/1389/2008 which may include information averaging periods for monitoring emissions to air. The method and averaging periods have also not been provided in the permit for discharges to water. Details of averaging periods were provided by the Operator, who indicated that the averaging periods applied at the installation were compliant with the permit requirements, although the permit does not specify these requirements directly. The Competent Authority did not provide any clarification on method or averaging periods. Other monitoring requirements in the permit are supported by GBRs that require the Operator to report on various parameters at defined frequencies **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** There was no evidence seen in the assessment that the requirements for monitoring as specified within the permit were derived directly from the BREF document. The permit references the GBR 430/2004 which specifies the requirement for continuous measurement of SO_2, NO_x and particulates emissions. **Does the permit include information on duration in relation to monitoring requirements?** Averaging periods are not specified in the permit, and this information was subsequently provided by the Operator, who indicated that averaging periods applied meet the requirements of the permit.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Annex III Section 8 of the permit specifies measures to adopt in abnormal conditions and for accident prevention. Measures for fire protection, prevention of serious accidents where hazardous substances may be involved, shut-down and start-up conditions and leakages and failure of equipment have been included.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Where conditions are placed in the permit that refers to the requirements to comply with GBR, the GBR reference is clearly given in each condition. It has not been possible for this assessment, due to time constraints, to assess whether the GBRs that the Operator must comply with are in line with the IPPC Directive
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** Based on the response from the Competent Authority, there are no relevant EQSs that required stricter conditions that those achievable through the use of BAT. The Competent Authority stated that the limits given in the permit were set out within the national and regional legislation and as such requires an assessment of the emissions from the installation having regard to air quality standards. It has not been possible, within the time constraints of this assessment, to assess how national/regional law ensures in all cases compliance with relevant AQSs. The opinion of the Competent Authority has been relied upon for the conclusion that local air quality standards were considered when determining permit conditions. Air quality monitoring data (ambient air) is available through the Competent Authority. According to the Competent Authority, there have been no breaches of local air quality limits.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit is valid for 8 years, as specified in the legislation 11/2003. Any changes to the installation operations results in a review of the permit conditions. The permit has not been reconsidered to date as it was only issued in August 2008. The permit conditions may need to be reviewed following the installation of the FGD plant.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes. The application and decision document is made available in paper format in an office providing public access during set hours. **Are monitoring records made available to the public?** Yes. Records are made available upon request and are available in paper format within the public register. The Operator indicated that their environmental performance data, including emissions to air, water, land, is made available to members of the public on the company website as a requirement of certification to the EMAS standard.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The operator currently employs continuous emissions monitoring (CEMs)for NO_x, SO_2 and particulates on point source air emissions from Group 1 and Group 2 boilers. All continuous monitoring must be undertaken in accordance with the standards laid out within specific component (air, water, waste) legislation. All periodic monitoring and checking/calibration of CEMs must be conducted by an accredited external organisation (OCA). CEMs are required to be serviced and operationally checked at least once per annum in accordance with the standard UNE-EN 14181. Noise levels are monitored at the installation. Monitoring of non-hazardous waste to the disposal site is required and annual quantities of each type of waste must be reported on an annual basis to the Competent Authority. Hazardous waste quantities are also monitored for each type of waste and reported on annually. Emissions to water from the installation and discharges to water, groundwater and leachate at the landfill site are monitored in accordance with the requirements of the regulating authority (Hydrographic Confederation).
Operator's compliance with monitoring conditions	The operator presently complies with the permit conditions relating to monitoring of emissions.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	Monitoring data for 2007/2008 was not available and the Operator stated that this is due to Group 1 and 2 being down for maintenance for some of this period. This data was requested by email and during the site interview, however it could not be provided for this assessment for reasons stated previously. Annual mass emissions data has been obtained from the environmental performance report 2006 for the installation, published on their website which shows that overall emissions of SO_2, NO_x, particulates and CO_2 have reduced over the period 2003 to 2006, with 2006 recording the lowest emissions for all pollutants. As this data is mass emissions data, it cannot be directly compared to the concentration limits within the permit issued in August 2008. A review of water emissions monitoring data from the installation, using 2007/2008 monitoring data results from the authorised control body, demonstrates that the majority of emissions were within the emission limits that applied during that period. Further information on emissions pre-IPPC is provided in Question 16 of the detailed assessment.
Current emissions of key pollutants	**This information is provided within the table below.** Table 2.1 below shows air emissions monitoring data for August 2008. The results below are presented as a monthly average value of the daily averages for each pollutant. As the permit was only issued at the end of July 2008, data for August is the only data that was available since the issue of the IPPC permit. This data is only available for Group 2 point source. Group 1 emissions data was unavailable for this assessment. The Operator stated that Group 1 has significantly reduced operating hours and has been down for some time, both for maintenance and in order to meet the requirements of the LCPD/NERP and therefore no monitoring data is available (it is understood that Group 1 was down for approximately 4 months) . Water emissions monitoring is undertaken by the regulating authority (Hydrographic Confederation) and the monitoring data (monthly averages) in the table below has been obtained for July and August 2008. Data was not available for all point sources, (i.e. PC-3 runoff from coal storage area), as there was no effluent during that period due to the shut down in operations. There was also no data available for point sources PC-7(treated sanitary water and rainfall water) and PC-8 (sanitary water from staff and hotel) for this period. Data is also not available for PC-5 (FGD plant) as it is not yet in operation (expected to be operational in March 2009).
Assessment of Installation performance against BAT	**Current performance:** <u>Emissions to Air</u> A review of emission performance of the installation using August 2008 monitoring results for Group 2 demonstrates that permit ELVs have been met for emissions to air with regards to daily averages of NO_x and SO_2. However, daily averages of particulate emissions were consistently above the permit ELVs throughout the monitoring period.

	Daily averages of SO_2, NO_x and particulates emissions are all outside the BAT-AEL ranges. SO_2 emissions from Group 2 for the monitoring period were 2,424 mg/Nm^3 (monthly average value of the daily averages for August) considerably higher than the BAT-AEL ranges of 20-200 mg/Nm^3. Particulate emissions were 90 mg/Nm^3, also exceeding the BAT-AEL range of 5-20 mg/Nm^3. The Operator commented during the interview that they expect a significant reduction in SO_2 and particulate emissions from the FGD plant, estimated to be a 95% reduction in SO_2 emissions and an 80% reduction in particulates. NO_x emissions were 905 mg/Nm^3 and higher than the BAT-AEL range of 90 – 200 mg/Nm^3, but within the limit value of 1,200 mg/Nm^3 set out in the LCPD for plants using fuel with a low volatile content (<10%). The BREF for LCPs indicates that the use of low volatile fuels can possibly lead to higher NO_x emissions. With regard to other aspects associated with the use of BAT, further information is provided in Question 18 of the detailed assessment. Emissions to Water Monitoring data for emissions to water from the installation (average over for July and August 2008), shows that all emissions are within permit ELVs for those point sources that data was available for. The BAT-AELs quoted in the tables below are those for emissions from the Flue Gas FGD (FGD) plant, as these were the only BAT emission levels provided in the BREF for wastewater treatment. Where BAT-AELs have been defined in the BREF, all emissions are within the BAT-AEL ranges. The Operator has demonstrated an increase in environmental spend on priority areas such as the FGD plant for reduction of SO_2 and particulates emissions and the wastewater treatment plant for the FGD. Further investment and implementation of NO_x emissions reduction measures will be over a longer period. Adjustments are being made to the boiler optimisation system (ABACO) to adapt to a wider range of coals, the Operator expects this will reduce NO_x emissions to 600-800 mg/Nm^3.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The Operator is required to present a site closure plan for the installation 6 months prior to site closure. Other conditions have been included for a soil, water and groundwater analysis study and assessment of polluted areas. Conditions are included for the gradual and definitive sealing of the current and the new landfill site. A post-closure maintenance plan is required to be included in the site closure plan; information to be included has been specified in the permit. The site closure plan for the landfill site must be presented to the Competent Authority 1 year before closure.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The Competent Authority reviews annual monitoring data that is submitted to them in accordance with the permit requirements. Any breaches of the limits or malfunctioning abatement equipment must be reported to the Competent Authority as soon as possible. The Operator must establish and maintain a book for recording measurements for air pollutants for inspection by the Competent Authority at any time. The Spanish Authorities have a system in place whereby a 'starting authorisation' is issued to an installation after 6 months of permit issue, provided that all conditions within the permit have been implemented. The Competent Authority has the power and a duty to enforce the regulations and may adopt a wide range of methods for doing this, which includes serving notices/shut-down/ prosecute operators that do not comply. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** Particulate emissions from Group 2 have exceeded permit ELV s. The Competent Authority was aware of this; however it is understood that no formal action had been taken (at the time of the site interview). **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The operator utilises continuous monitoring to ensure compliance. A CEM system is in place to ensure that any anomalies are identified immediately and this information is reported to the Competent Authority. All CEM equipment is calibrated annually by an external accredited company. The Operator must establish and maintain a book for recording measurements for air. **Procedures used or action taken by the operator in the event of non-compliance** In the event of a beach of a permit ELV, the Competent Authority must be notified immediately. The Operator has a procedure in place to follow in the event of a non-compliance with permit conditions, as part of the EMS.
Operator must afford the competent authority all	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?**

necessary assistance to allow inspections to be carried out, to gather information and to take samples	Normally, the Competent Authority would undertake site inspections every 2-3 years. There have been a number of visits by the Competent Authority in the past year to the installation to discuss issue relating to permit determination. The Competent Authority stated that the Operator has always been willing to participate and assist in site inspections. The Hydrographic Confederation undertakes 4-6 inspections a year to check compliance with water emission limits.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Results of monitoring are held on the public register and are available upon request. No formal publication of the information is made by the Competent Authority or the operator. This information can be formally requested.

Key observations from this case study assessment

- The Operator submitted an application for an IPPC permit that contained the key elements required by Article 6.
- The concentration emission limits set in the permit for Group 1 are clearly higher than the BAT-AELs in the BREF. It appears BAT is not being applied in Group 1 as a result of the decision to reduce operating hours of the plant. In this way, the overall annual mass emission limits set under the LCPD NERP can be met. The focus for the installation has been on abatement measures for Group 2. This unit is being equipped with FGD, which will be operational from March 2009. The currently applicable concentration limit value for SO_2 from Group 2 (those that apply before FGD plant is operational) are not considered to be based on BAT. The ELVs for SO_2, NO_x and particulates, which will apply after the FGD is operational, are all outside the BAT AEL range. For NO_x, this is understood to be related to the use of low volatile coal.
- The installation is covered under the NERP under the LCPD. Annual mass emission limits or bubble limits for Spanish LCP installations under the NERP have been set out in Order PRE/77/2008, which apply from 2008 to 2015. There are four groups within the bubble limit including Group 1 and 2 and two other installations. Emission data from August 2008 of SO_2, NO_x and particulates from Group 2 are all outside the BAT-AEL ranges. Particulate emission levels exceeded the permit ELV. SO_2 and NO_x emissions were within the permit ELVs. The Operator was not able to provide recent monitoring data for Group 1 as the plant had been in shutdown for a number of months and monitoring data was not available (as described above).
- It was not clear from the assessment of the permit and discussion with the Competent Authority how local environmental conditions and the geographical location were taken into consideration when setting permit ELVs and conditions. The installation is located within a national park and discharging to a river of, according to the Competent Authority, very high quality. However, details of the processes for considering these local factors and local air quality data were not provided by the Competent Authority in the permit or by means of supporting documentation. It was not possible within the timescales for this study to obtain clarification on this issue from the Ministry of Environment for Spain.
- The Operator has demonstrated an increase in environmental spend on priority areas such as the FGD plant for reduction of SO_2 and particulates emissions and the wastewater treatment plant for the FGD. Adjustments are been made to the boiler optimisation system (ABACO) to adapt to a wider range of coals, the Operator expects this will reduce NO_x emissions to 600-800 mg/Nm^3. There is insufficient information on methods and averaging periods for discharges to water.
- Monitoring methods and averaging periods have not been provided within the permit. Actual averaging periods that are applied at the installation were provided separately by the Operator. However it has not been determined if these meet the requirements of the permit. For emissions to air, actual averaging periods applied are the same as specified in BREF (daily averages).
- The Competent Authority site inspections are considered to be relatively infrequent (every 2-3 years) in terms of ability to assess the site for compliance with permit conditions.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	**Sampling or measuring time**	**Ref. Cond.**
Emissions to air									
F1 Group 1 Boiler	SO2	No data	3000 mg/Nm^3	20-200 mg/Nm^3	No data	No data	Continuous	Daily average (actual averaging period applied at installation) (averaging period not specified in permit) (BREF indicates daily averages)	101.3 kPa, 273°K, 6%O2
	NOx		1750 mg/Nm^3	90-200 mg/Nm^3			Continuous		101.3 kPa, 273°K, 6%O2
	Particulates		280 mg/Nm^3	5-20 mg/Nm^3			Continuous		101.3 kPa, 273°K, 6%O2
F2 Group 2 Boiler1 (limits apply before FGD plant in operation)	SO2	2424 mg/Nm^3	3000 mg/Nm^3	20-200 mg/Nm^3	Yes	No	Continuous	Daily average (actual averaging period applied at installation) (averaging period not specified in permit) (BREF indicates daily averages)	101.3 kPa, 273°K, 6%O2
	NOx	905 mg/Nm^3	1200 mg/Nm^3 (Note 3)	90-200 mg/Nm^3	Yes	No	Continuous		101.3 kPa, 273°K, 6%O2
	Particulates	90 mg/Nm^3	50 mg/Nm^3	5-20 mg/Nm^3	No	No	Continuous		101.3 kPa, 273°K, 6%O2

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling or measuring time	Ref. Cond.
F2 Group 2 Boiler 1 (limits apply when FGD plant in operation)	SO2	No data	400 mg/Nm^3	20-200 mg/Nm^3	No data	Unknown	Continuous	Daily average (actual averaging period applied at installation) (averaging period not specified in permit) (BREF indicates daily averages)	101.3 kPa, 273°K, 6%O2
	NOx		1200 mg/Nm^3 (Note 3)	90-200 mg/Nm^3			Continuous		101.3 kPa, 273°K, 6%O2
	Particulates		50 mg/Nm^3	5-20 mg/Nm^3			Continuous		101.3 kPa, 273°K, 6%O2

Notes:

Monitoring data for F2 Group 2 (before FGD in operation) is from Aug2008. The values presented above are a monthly average v of the daily average values for August. Monitoring data prior to this was not available as Group 2 was shut down for maintenance from Mar 2008 – Jun 2008.

Monitoring data for Group 1 could not be provided due to shutdown of this plant.

[1]These limits currently apply, until FGD plant is in operation.

[2]These limits apply once the FGD plant is in operation.

[3] This NO_x limit has been set based on a derogation in the LCPD Annex VI note 3 which states: ‘Until 1st January 2018 in the case of plants that in the 12 month period ending on 1 January 2001 operated on, and continue to operate on, solid fuels whose volatile content is less than 10 %, 1 200 mgNO_x/Nm^3 shall apply’. The BREF indicates that there may be higher emissions from use of low volatile fuels.

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	**Sampling or measuring time**	**Ref. Cond.**
Emissions to water from the main installation									
PC-1 Refrigeration and cleaning water in Group 1	Suspended Solids	1 mg/l	<5 mg/l	5-30 mg/l	Yes	Yes	Weekly	Not specified in permit (Actual avg. periods not confirmed by Operator) (BREF indicates daily averages)	N/A
	COD	Below detection limit	<3 mg/l O_2	<150 mg/l O_2	Yes	Yes	Monthly		N/A
	Ammonium	Below detection limit	<1 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A
	Nitrites	Below detection limit	<0.01 mg/l	<50 mg/l	Yes	Yes	Monthly		N/A
	Total Phosphorus	Below detection limit	<0.2 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A
	Zinc	Below detection limit	<0.3 mg/l	<1 mg/l	Yes	Yes	Weekly		N/A
	Copper	Below detection limit	<0.04 mg/l	<0.5mg/l mg/l	Yes	Yes	Monthly		N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling or measuring time	Ref. Cond.
	Lead	Below detection limit	<0.02 mg/l	<0.1 mg/l	Yes	Yes	Monthly	Not specified in permit (Actual avg. periods not confirmed by Operator) (BREF indicates daily averages)	N/A
	Total Chromium	Below detection limit	<0.02 mg/l	<0.5 mg/l	Yes	Yes	Monthly		N/A
	Nickel	Below detection limit	<0.02 mg/l	<0.5 mg/l	Yes	Yes	Monthly		N/A
PC-2 Wastewater from the treatment plant	pH	8.59	6-9	No BAT-AEL in BREF	Yes	N/A	Continuous	Not specified in permit (Actual avg. periods not confirmed by Operator) (BREF indicates daily averages)	N/A
	Suspended Solids	6 mg/l	30 mg/l	5-30 mg/l	Yes	Yes	Weekly		N/A
	COD	<10 mg/l O_2	160 mg/l O_2	<150 mg/l O_2	Yes	Yes	Monthly		N/A
	Oils and Greases	<0.05 mg/l	5 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A
	Ammonium	3.52 mg/l	15 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling or measuring time	Ref. Cond.
	Nitrites	0.13 mg/l	1 mg/l	<50 mg/l	Yes	Yes	Monthly		N/A
	Nitrates	1.85 mg/l	50 mg/l	<50 mg/l	Yes	Yes	Weekly		N/A
	Total Phosphorus	0.12 mg/l	2 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A
	Chlorides	8.44 mg/l	2000 mg/l	No BAT-AEL in BREF	Yes	N/A	Weekly		N/A
	Sulphates	387.55 mg/l	2000 mg/l	1000-2000 mg/l	Yes	Yes	Weekly		N/A
	Zinc	0.03 mg/l	1 mg/l	<1 mg/l	Yes	Yes	Weekly		N/A
	Copper	0.015 mg/l	0.5 mg/l	<0.5 mg/l	Yes	Yes	Monthly		N/A
	Nickel	<0.02 mg/l	0.02 mg/l	<0.5 mg/l	Yes	Yes	Monthly		N/A
	Iron	0.26 mg/l	1 mg/l	No BAT-AEL	Yes	N/A	Weekly		N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling or measuring time	Ref. Cond.
PC-4 Refrigeration tower water from Group 2 (no wastewater treatment required)	pH	9	6-9	No BAT-AEL in BREF	Yes	N/A	Continuous	Not specified in permit (avg. periods not confirmed by Operator) (BREF indicates daily averages)	N/A
	Suspended Solids	6 mg/l	30 mg/l	No BAT-AEL in BREF	Yes	N/A	Weekly		N/A
	COD	<3 mg/l	<3 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A
	Free residual Chlorine	<0.05 mg/l	0.2 mg/l	No BAT-AEL in BREF	Yes	N/A	Weekly		N/A
	Ammonium	<0.4 mg/l	1 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A
	Nitrites	<0.05 mg/l	0.05 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A
	Total Phosphorus	0.33 mg/l	1 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling or measuring time	Ref. Cond.
	Zinc	0.075 mg/l	1 mg/l	No BAT-AEL in BREF	Yes	N/A	Weekly		N/A
	Copper	0.28 mg/l	0.5 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly	Not specified in permit (avg. periods not confirmed by Operator) (BREF indicates daily averages)	N/A
	Total Chromium	<0.02 mg/l	0.1 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A
	Lead	<0.04 mg/l	0.1 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A
	Nickel	<0.04 mg/l	0.1 mg/l	No BAT-AEL in BREF	Yes	N/A	Monthly		N/A

3.3.10 Case study 7 – United Kingdom

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/UK/34. The information in this table is based on the detailed assessment for this installation in Appendix B7. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The primary activity of the Installation is the combustion of fuel in a plant with a rated thermal input of 50MW or more. The installation is a large combustion plant falling under Annex 1 Category 1.1 'combustion activities with a rated thermal input exceeding 50MW' of the IPPC Directive. The installation comprises a large complex for the generation of electrical power from turbo-alternators driven by steam raised by the combustion of coal, biomass and petroleum coke (the latter two fuels are minor – normally less than 20% blends) with coal and oil. Coal is the main fuel used and contains in the range of 0.4 - 2.8% sulphur. There are 6 separate boiler and generator units. The first units were built in the 1970s and the second two units were built in the early 1980s. The plant is characterised as an existing plant under the LCP. Boiler units 1-6 have a rated thermal input capacity of 1,700 MWth using pulverised coal and biomass with oil (heavy fuel oil or renewable oils (talloil) for light up and auxiliary firing). There are also 6 open cycle gas turbines (and an additional 3 gas turbines in commission) with 125MWth capacity each, using gas oil fuel and these are used for standby for grid emergencies. There are 2 auxiliary boilers each rated at 20 MWth installed for boiler fuel oil heating, boiler oil burner atomization, office heating and hot water supply. The installation has 3 flues and 1 chimney stack. A stock of coal is held in profiled stockpiles on the installation site. Emission abatement techniques used at the installation: • All 6 boiler units are served by wet limestone-gypsum flue gas desulphurisation (FGD) plant to remove approximately 90% of sulphur dioxide in combustion gases. • Electrostatic precipitators are used to control particulate emissions from the installation. When the FGD plant is out of service there is the potential for some increase of particulate emissions, particularly with low sulphur coals as electrostatic precipitators are less efficient with these coals. To overcome this, the Operator has introduced SO_3 injection equipment. • All boilers are fitted with low NO_x burners and all units have been retrofitted with Boosted Over Fire Air (BOFA) low NOx technology. No secondary NOx abatement is installed
Type of permit / issue date	The application was reviewed and met the requirements of Article 6 of the IPPC Directive by the Competent Authority on 30th March 2006. Formal requests were made by the Competent Authority for the Operator to provide additional information to support the application. The permit was formally signed and issued on 30ttth October 2007. The Operator holds a separate IPPC permit for the separate ash disposal site, issued on the 29th March 2007. The IPPC permit supersedes the authorisation issued 8th April 1993 under the previous UK IPC (Integrated Pollution Control) regime.

Basis of BAT determination	The UK published "Sector Guidance Note" for 'Combustion Activities' V2.03 was used to determine BAT for the installation. This guidance sets out the UK's interpretation of BAT for Large Combustion Plants (BAT as interpreted by the Competent Authority for the UK: this is not the same in all cases as BAT according to the BREFs, as elaborated upon further below). There was good communication across the combustion sector in developing the Sector Guidance, through consultations and workshops, which helped significantly in writing the application and permit determination. The LCP BREF document was also used as a reference source to assess BAT. The Competent Authority's (Environment Agency's) Guidance *'Framework for the Regulation of Existing LCPs at Power Stations in England and Wales: 2008-2015'*, has been developed to provide the Member State view of what constitutes BAT to control emissions of SO_2, NO_x and particulates from LCPs. This guidance was prepared taking into account the technical information on the performance of various abatement techniques within the BREF document. The Competent Authority notes that whilst BAT assessment is installation specific, the LCP within the Member State are of sufficiently similar design that they have been able to set out their view of sector level BAT within the 'Framework' document. The installation is also covered by the National Emissions Reduction Plan (NERP) under the LCP Directive and therefore allocations are made to the Operator in the IPPC permit as Operator NERP limits or annual mass compliance limits.
Permit application	
Requirements of Article 6	The Competent Authority (CA) worked with the operator to ensure all required sections in the IPPC application were addressed in order for the requirements of Article 6 to be met. It was indicated at the interview that developing the (national) Sector Guidance for the Combustion Sector was very beneficial to the operators (according to them) in writing the applications. The Competent Authority stated that the sector is very advanced in regulatory and reporting requirements, and was prepared for the requirements under the new IPPC regime. A number of formal, written requests for further information were issued to the Operator requesting clarification and additional supporting material. These Notices effectively paused the permit determination process. Further information was also requested as part of improvement conditions.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The IPPC permit has been developed by the Competent Authority in such a manner that conditions are placed within the permit to ensure that the installation is operated in accordance with the requirements of Article 3 (a-f). (See below). Where the Operator is not applying BAT or meeting the requirements of Article 3, Improvement Conditions have been used to require the Operator to implement such measures that would be necessary to meet the requirements of Article 3. Nineteen improvement conditions have been included within the permit, with specific dates set out for implementation of each condition. Many conditions were required to be implemented by the end of 2008, with two conditions on water efficiency and waste minimisation audits required to be presented to the Competent Authority by September 2009. A generic condition has been included on the preparation of a report to the Competent Authority based on an assessment by the Operator on the prevention and minimisation of all pollution from the installation. This is to be prepared by October 2010. The review of the permit for this assessment showed that all conditions within the permit are either BAT or improvement conditions are included to meet BAT (BAT as interpreted by the Competent Authority for the UK and set out in the 'Sector Guidance' document and the 'Framework' document for LCPs to meet the requirements of the LCPD; this is not the same in all cases as BAT according to the BREFs, as elaborated upon further below).
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	Conditions are placed in the permit that relate to the requirement to comply with the annual mass compliance limits for emissions of SO_2, NO_x and particulates of the permit. These limits have been based on the 'Framework' document for LCPs, to meet the requirements of the LCPD NERP. The permit also sets out ELVs for emissions to water which have been based on the Sector Guidance document. Full details of these limits are available in Table A1.b of the full assessment report in Appendix B7.

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Air:

The permit sets annual mass emission limits for SO_2 and NO_x at 1.8 t/GWh generated which apply since 1st January 2008. An emission limit of 25 mg/m^3 (monthly average) has been set for particulate emissions.

The supporting documentation to the permit states that as a minimum the installation will comply with the requirements of the LCPD and also NERP limits for the installation. After 01/01/2008, compliance with the LCPD is based on the Large Plant definition of all units discharging to a single stack (the installation has one stack). Hence, compliance will be assessed on period averages for the sum of emissions form the whole stack- treated as a single emission point.

The permit also sets out 'A' limits (caps) for SO_2 and NO_x (annual tonnage emission limits) for the installation derived from data from six monitoring stations in the area. These limits cannot be exceeded and are provided as maximum limits for compliance with local and national air quality standards.

Water:

An ELV of 0.1 mg/l has been set for copper in the discharge to water. This limit has been set in addition to an improvement condition that requires the operator to carry out a mass balance of copper through and from the site.

There is no ELV for suspended solids from discharge point W1. A limit of 40mg/l suspended solids has been set on the FGD outlet W2, which has been identified as the only part of the water circuit where appreciable amounts of solids could be added. ELVs for mercury and cadmium have been included in the permit, based on the Sector Guidance Note benchmark levels (0.005mg/l for Hg and 0.01mg/l for Cd).

Rationales for the decisions on ELVs for water discharges are presented in Q5 of the full assessment report in Appendix B7.

Land:

There are no site specific ELVs set for emissions to land.

Protection of soil and groundwater

Soil or groundwater discharges are not permitted by the permit.

Waste

No specific conditions for quantities of waste produced have been set in the permit. The rationale for this has been given in the decision document to the permit and is available in Q5 of the full assessment report. The Competent Authority was satisfied that appropriate measures are in place at the installation to avoid waste production as far as possible, and where waste is produced it will be recovered unless technically and economically impossible.

Transboundary considerations

The permit does not specifically contain conditions that relate to transboundary impacts and minimisation of transboundary pollution; however the impact assessment undertaken (particularly with regard to SO_2 and NO_x) considered such impacts. The assessment concluded no adverse effect was expected on the integrity of any European (protected) Sites within the UK from aerial emissions of SO_2 and NO_X. In the case of aqueous discharges, it was concluded that no adverse effect on European SAC, SPA and Ramsar sites was expected.

Further equivalent technical parameters/measures have been set for:

(1) Limits and controls on the use of fuels.

- Heavy fuel oil - shall contain less than 1% sulphur
- Gas oil - shall contain less than 0.1% sulphur (w/w)
- Biomass fuels – as defined in Article 2 (11) of Directive 2001/80/EC
- Petroleum Coke co-combusted with coal at maximum of 20% of coal feed (instantaneous value) or 15% as a monthly unit average.

(2) Permitted waste types, descriptions and quantities which can be accepted at the installation are specified in Schedule 3 Table S3.2: Any waste subject to the Waste Incineration Directive (WID) has been excluded.

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<td>Inclusion of permit conditions based on BAT (Article 9(4))</td>
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Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?

There is clear evidence throughout the Competent Authority decision document that permit conditions have been based on a site-specific assessment of the installation using the UK Competent Authority

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Sector Guidance for 'Combustion Activities' (V2.03), which interprets BAT and the guidance' Framework *for the Regulation of Existing LCPs at Power Stations in England and Wales: 2008-2015'* which sets out measures to allow LCPs to meet the requirements under the LCPD.

Emissions to Air

The permit sets annual mass emission limits for SO_2 and NO_x at 1.8 t/GWh generated, which apply since 1st January 2008.

The Competent Authority consider that for all LCPs in the UK that are in the LCPD NERP, sector level BAT to reduce SO_2 emissions is based on the use of FGD (or an equivalent technique) at 90% efficiency on a UK coal of 1.75% sulphur. All LCP under the NERP must meet an annual emission limit of 1.8 t SO_2/GWh generated to emit at a benchmark concentration of 400 mg/m^3 SO_2. This concentration limit is based on limits within the LCPD for SO_x.

The BREF indicates that Selective Catalytic Reduction (SCR) is sector level BAT to reduce emissions of NO_x. However, the Competent Authority has concluded that SCR and reburn are not economic to retrofit on existing coal and oil fired LCP at present and considers that sector level BAT for LCP firing high volatile coal to be low NO_x burners and Over Fire Air (OFA). This is therefore not in accordance with BAT in the BREF. LCP are required to meet an annual mass emission limit of 1.8 t NO_x/GWh generated, to emit at a benchmark concentration of 500 mg/m^3. This concentration limit is based on limits within the LCPD for NO_x. with the use of OFA. The installation has in 2008 retrofitted all units with OFA technology.

Although no direct comparison can be made between annual emission limits for SO_2 and NO_X in the permit (1.8 t/GWh) and the BAT-AEL (daily concentration levels) from the BREF (90-200 mg/m3 for NO_x and 20-200 for SO_2 emissions), it is clear that the concentration levels corresponding with the permit ELVs are above the BREF BAT-AEL ranges for these pollutants.

LCPs under the NERP are not required to meet the benchmark concentration limits for SO_2 and NO_X described above, these are benchmarks calculated by the Competent Authority to ensure that LCPs do not use up their NERP allocation in a short period but spread out their emissions over the assessment year to allow them to meet the annual mass emission limit of 1.8 t/GWh.

Electrostatic precipitators and FGD are regarded by the national authorities as BAT for particulate emissions control on coal fired LCP, which is reflected in the binding permit ELV of 25 mg/m^3 (monthly average) with FGD. This exceeds the BAT-AEL in the BREF which is 5-20 mg/m^3 (daily average).

The UK *'Framework for the Regulation of Existing LCPs at Power Stations in England and Wales: 2008-2015'*, provides a particulate emission benchmark concentration value of 50mg/m^3 (monthly average) for LCP without FGD (however this is not set out in the permit as all units are served by an FGD).

Emissions to Water

All permit ELVs for emissions to water were within the BAT-AEL ranges (where applicable).

	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? An impact assessment has been completed as part of the application (H1 assessment) for the most significant emissions from the installation. This assessment takes into consideration specific local environmental conditions and geographic location of the installation. Emissions to air (SO_2, NO_X, particulates) and water emissions that were identified as significant from the initial assessment were then more thoroughly reviewed by the Competent Authority. Local Air Quality reports showed compliance with all Air Quality EU derived standards and UK Objectives. The installation operates within an Ambient Air Quality Network along with two other power stations. The installation has an Air Quality Management Plan (AQMP). These plans are set up on an area basis by the Competent Authority and implement the requirements of the Air Framework Directive. Under the AQMP, the Operator is required to monitor ambient air quality and report on compliance with Air Quality Standards. The operator was required to prepare an Impact Assessment under the Habitats Directive. The assessment concluded no adverse effect was expected on the integrity of any European Sites within the UK from aerial emissions of SO_2 and NO_X. In the case of aqueous discharges, it was concluded that no adverse effect on European SAC, SPA and Ramsar sites was expected. As mentioned previously, the permit sets out 'A' limits (caps) for SO_2 and NO_x (annual tonnage emission limits) for the installation derived from data from six monitoring stations in the area. These limits cannot be exceeded and are effectively a 'harm' limit in relation to local and national air quality standards. These limits are considered maximum limits that the Competent Authority in the UK consider acceptable for SO_x and NO_x emissions. Overall national limits would exert a stricter cap on emissions. Under the aforementioned "Framework for the Regulation of Existing LCPs at Power Stations in England and Wales: 2008-2015", there are also cap and trade sector limits on total annual emissions of SO_2 and NO_x, in the form of transferable Operator "B" Limits for LCP under LCPD ELV; and a parallel but independent arrangement for SO_2, NO_x and particulates for those under a NERP. **Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?** None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** The UK Competent Authority have concluded that SCR and reburn are not economic to retrofit on existing coal and oil fired LCP at present *at a sector level*. This does not, therefore, relate to operator's economic circumstances at the level of individual installations but rather an approach on a Member State level that is likely to have been duplicated on a number of LCP sites across the UK.
Use of relevant BREF documents in setting permit conditions?	The UK Sector Guidance Note for 'Combustion Activities' V2.03 was used to assess "BAT" for the installation, not the BREF for LCPs. The Sector Guidance is the UK interpretation of the BREF document for LCPs. This guidance document is designed to complement the BREF and take into account information contained in the BREF in setting out indicative BAT standards and expectations for LCPs in the UK.

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains comprehensive monitoring requirements. These requirements specify the methods, frequencies and referencing periods (where applicable) and an obligation to supply this information to the CA. Monitoring and reporting frequencies for emission to air have been determined based on the requirements of the LCPD. Continuous emissions monitoring is carried out on the single stack (Windshield 1) for NO_x, SO_2 and particulates. An improvement condition has been set which addresses monitoring of water from the site inlet and discharges, to ensure the most appropriate method is being used. **Are the monitoring requirements sufficiently detailed?** The Operator indicated that the monitoring requirements are sufficiently detailed to enable them to clearly understand what monitoring is required and how to undertake it. **Do the monitoring requirements take into account the details contained within the BREF documents?** Continuous emissions monitoring is carried out for all the main pollutants. The Competent Authority has developed a single monitoring standard for operators of industrial installations. This system, known as MCERTS, has been developed having regard to the requirements of the Monitoring BREF document. The permit requires the Operator to utilise technologies and techniques for monitoring that are compliant with the MCERTS scheme or appoint contractors that are compliant. The majority of monitoring equipment, techniques and personnel are certified to MCERTS, and where MCERTS has not been applied an improvement condition has been included in the permit to address this. **Does the permit include information on duration in relation to monitoring requirements?** Yes, sufficient information is provided within the permit on averaging periods for monitoring.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	There are specific requirements for operating techniques for installations under LCPD (NERP approach). Conditions have been placed in the permit that provide for protection of the environment in the event of a malfunction or breakdown of abatement equipment and for the operation of a boiler without the simultaneous operation of the FGD (which are based on LCPD, Article 7). Protocols have been developed by the industry Working Group and the Competent Authority which should be used by LCPs in the above conditions, these Protocols are referenced in the permit.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** No
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** Overall, the conditions for air emissions are not stricter than those achievable by the use of BAT. The Competent Authority stated that there have been no breaches of the local air quality limits since issue of the permit. Local air quality data was assessed by the competent authority when determining permit conditions, as specified in the supporting documentation to the permit (though this has not been reviewed for the purposes of this case study assessment).
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit does not provide a specific date on validity or expiration of the permit. However, an improvement condition in Schedule 1 S1.3 has been set requiring the operator to prepare a report on any other measures that could be taken to prevent or minimise pollution for the activities covered in the permit and the report will be of sufficient detail to allow for a permit review. The date specified for completion of this condition is 31st October 2011 (i.e. four years from issue of the permit).
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes, these documents are available on the public register. **Are monitoring records made available to the public?** Yes, monitoring data is made available to the public through the Competent Authority's "Pollution Inventory". In addition, the Operator provides installation environmental performance data in the annual environmental report.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The Operator has confirmed that monitoring is undertaken in accordance with the requirements of the permit conditions. Monitoring data have been provided for the purposes of this assessment. Continuous emissions monitoring is carried out on Units 1 to 6, having continuous monitoring of NO_x, SO_2 and dust together with continuous monitoring of oxygen, temperature and pressure. CEMs are integrated to a system to give management information to check compliance with LCPD and IPPC and to calculate mass NO_X, SO_2 and particulate emissions. CEMS have been used on all units for several years but their use has only been mandatory since 1/1/2008. The location of the CEMs has not been determined for this assessment. Continuous emissions monitoring is in place at W1 the discharge point to river for pH, temperature and flow. Weekly monitoring is undertaken for copper and monthly monitoring for mercury and cadmium. Total suspended solids are monitored weekly on the W2 point.
Operator's compliance with monitoring conditions	The Operator and Competent Authority have confirmed that monitoring is undertaken in accordance with the requirements of the permit conditions. It is also the conclusion of this assessment that monitoring carried out at the installation meets the requirements of the permit.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	Mass emission data is available in Q16 of the full assessment report in Appendix B7. Annual mass emissions data (kt/year) for the period 2000-2007 shows that there has been an overall annual downward trend for the majority of emissions to air (NO_x, SO_2, particulates, HCl). This is also true when calculated on a per MWh basis
Current emissions of key pollutants	This information is provided within the table below. An average of the monthly emissions data (tonnes) for SO_x and NO_x and concentration data for particulates was used to assess installation performance. Monitoring data is for the year to date (Jan 2008 – Jul 2008, the latter being when the site visit took place).
Assessment of Installation performance against BAT	**Current performance:** Assessment of the available annual mass emissions monitoring data demonstrates that emissions from all measured points are within permit mass emission limits. However, the installation permit was issued in October 2007 and as such no complete monitoring records (covering a whole year) were available from the Operator. Continuous emissions concentration data for SO_x and NO_x was not provided for this assessment, only mass emission data, and therefore, a meaningful comparison of current performance could not be made against BAT-AELs (this information was requested from the Competent Authority and Operator). Water emissions from the installation are all within the permit ELVs and BAT-AEL ranges.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	Conditions in Section 2.7 of the permit require that the Operator maintains and operates activities so as to ensure prevention or, where this is not possible, minimises pollution risk upon closure and decommissioning. A site closure plan is required and it must be reviewed at least every four years with implementation of the plan required at cessation of activities.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the competent authority for ensuring compliance:** The Competent Authority produces an annual Compliance Assessment Programme (CAP) for the installation. This CAP details the types and frequencies of audits, inspections and reviews that will be undertaken in the coming 12 months and the areas that will be priority for investigations. The Competent Authority carries out 1-2 major audits per year where all areas of the permit are looked at, with particular focus on the priority areas. These audits may also include the taking of spot samples to check compliance. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** The Competent Authority and Operator confirmed during the site visit that there have been no incidences of non-compliance with the permit requirements. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The Operator has internally-drafted procedures that detail the actions that are required to ensure compliance with each permit condition. There is an internal permit compliance process whereby any anomalies in monitoring data are identified and results are discussed with Senior Management at monthly meetings. Trend analysis on all reporting requirements is undertaken. Data on emissions of SO_2 and NO_x is monitored continuously and summaries made available to management daily. Operators are trained on environmental procedures for operational control to ensure compliance with the IPPC permit. An Environmental Management System is in place and has been integrated with the IPPC permit requirements. The EMS is certified to ISO14001 standard and is audited twice a year. **Procedures used or action taken by the operator in the event of non-compliance** The Operator has drafted internal procedures for reporting breaches against permit conditions. The permit contains specific reporting forms for any breach of ELV or conditions.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The Competent Authority carries out 1-2 major audits per year where all areas of the permit are looked at, with focus on the priority areas, including all major plant, abatement equipment, the CEM system, etc. There had been one site investigation in 2008 (as of August 2008 when the site visit took place) which focused on CEMS validation. This investigation included an assessment of the monitoring equipment, calibration and the process for logging faults with the equipment. The entire CEMS system was inspected, paper records and measurements taken. Actual results from the audit were not obtained for this assessment. However, the Competent Authority commented within the site interview that the CEMs system was meeting all the requirements of the permit and operational requirements set out in National guidance produced by the Joint Combustion Industry/Competent Authority Group, the JEP, for stack monitoring entitled '*Use of CEMS for Reporting Emissions of SO_2, NO_x and Dust under PPC and the LCPD. A Guide to current Best Practice for the Operators of Coal and Oil Fired Boilers, December 2006'.*
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Annual monitoring data is available on the public register. It is understood that details of compliance audits are not published.

Key observations from this case study assessment

- An assessment of the IPPC application shows that all the requirements of Article 6 of the Directive have been met.
- The IPPC permit has been developed by the Competent Authority in such a manner that conditions are placed within the permit to ensure that the installation is operated in accordance with the requirements of Article 3 (a-f).
- The Competent Authority has taken a structured approach in the UK to permitting installations. It was apparent that many discussions took place at a strategic level between Operators, industry Working Group and Regulatory Authorities regarding the requirement to achieve consistency in permitting this sector. For this particular case study, this has resulted in a concise permit, which contains conditions that address each of the Directive's requirements and that is supported by a very clear and comprehensive decision document.
- With the exception of the mass emission limits for air pollutants set in the permit, all other conditions within the permit are considered to represent BAT as provided in the BREF.
- Permit limits for emissions to air have been set based on the LCPD NERP and are expressed as annual mass emission limits (t/GWh) and not on the basis of BAT as defined in the LCP BREF. A comparison cannot directly be made between emissions expressed in t/GWh and BAT-AEL concentrations values although, as a result of decisions concerning BAT on a sectoral level made within national guidance, it is considered unlikely that emissions will be within BAT-AEL ranges. The emission limit in the permit for particulates is above the BAT-AEL range for this pollutant. All ELVs for emission s to water are within the BAT-AEL ranges for parameters measured.
- Assessment of the performance of the installation against permit conditions indicates that the installation is in compliance with mass emissions limits, although monitoring data for the full assessment year under NERP was not available. Monitoring data provided by the Operator shows only mass emissions (t/GWh); concentration data was not available for this assessment, therefore a comparison against BAT-AELs could not be made. The Operator is in compliance with all permit ELVs for emissions to water based on the data provided.
- Where there have been concerns about certain emissions, i.e. high copper levels in water discharges, emission limits and improvement conditions have been included in the permit, intended to ensure that these pollutants do not make a significant contribution to the background concentrations in the receiving environment.
- The installation operates an Air Quality Management Plan to monitor ambient air quality in the surrounding area and ensure compliance with local and national air quality standards. The Competent Authority confirmed that there have been no breaches of local air quality limits since the issue of the permit.
- There is clear evidence (as provided above), through supporting documentation to the permit and discussions with the Competent Authority, that specific technical characteristic of installation, geographic location or local environmental conditions were considered when setting permit conditions.
- It can be concluded that, where information was available to assess, the installation appeared to be meeting the requirements of the LCPD (at the time of this assessment).

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
AU1	SO_2	1.11 t/GWh	1.8t/GWh [1]	20-200 mg/Nm^3	Yes	See Note 4	Continuous	Annual (same as permit) (BREF indicates daily average)	6% O_2
	NO_X	1.5 t/GWh	1.8t/GWh [2]	90-200 mg/Nm^3	Yes	See Note 4	Continuous		6% O_2
	Particulates	4.90 mg/m^3	25mg/m^3 [3]	5-20 mg/Nm^3	Yes	Yes	Continuous BS EN13284-2	Monthly (same as permit) (BREF indicates daily average)	6% O_2
AU2	SO_2	0.67 t/GWh	1.8t/GWh [1]	20-200 mg/Nm^3	Yes	See Note 4	Continuous	Annual (same as permit) (BREF indicates daily average)	6% O_2
	NO_X	1.51 t/GWh	1.8t/GWh [2]	90-200 mg/Nm^3	Yes	See Note 4	Continuous		6% O_2

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
AU3	Particulates	7.80 mg/m^3	25mg/m^3 [3]	5-20 mg/Nm^3	Yes	Yes	Continuous BS EN13284-2	Monthly (same as permit) (BREF indicates daily average)	6% O_2
	SO_2	0.96 t/GWh	1.8t/GWh [1]	20-200 mg/Nm^3	Yes	See Note 4	Continuous	Annual (same as permit) (BREF indicates daily average)	6% O_2
	NO_X	1.56 t/GWh	1.8t/GWh [2]	90-200 mg/Nm^3	Yes	See Note 4	Continuous		6% O_2
	Particulates	3.28 mg/m^3	25mg/m^3 [3]	5-20 mg/Nm^3	Yes	Yes	Continuous BS EN13284-2	Monthly (same as permit) (BREF indicates daily average)	6% O_2
AU4	SO_2	0.63 t/GWh	1.8t/GWh[1] [1]	20-200 mg/Nm^3	Yes	See Note 4	Continuous	Annual (same as permit) (BREF indicates daily average)	6% O_2
	NO_X	1.34 t/GWh	1.8t/GWh [2]	90-200 mg/Nm^3	Yes	See Note 4	Continuous		6% O_2

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
AU5	Particulates	5.15 mg/m^3	25mg/m^3 [3]	5-20 mg/Nm^3	Yes	Yes	Continuous BS EN13284-2	Monthly (same as permit) (BREF indicates daily average)	6% O_2
	SO_2	0.57 t/GWh	1.8t/GWh [1]	20-200 mg/Nm^3	Yes	See Note 4	Continuous	Annual (same as permit) (BREF indicates daily average)	6% O_2
	NO_X	1.60 t/GWh	1.8t/GWh [2]	90-200 mg/Nm^3	Yes	See Note 4	Continuous		6% O_2
AU6	Particulates	5.0 mg/m^3	25mg/m^3 [3]	5-20 mg/Nm^3	Yes	Yes	Continuous BS EN13284-2	Monthly (same as permit) (BREF indicates daily average)	6% O_2
	SO_2	0.68 t/GWh	1.8t/GWh [1]	20-200 mg/Nm^3	Yes	See Note 4	Continuous	Annual (same as permit) (BREF indicates daily average)	6% O_2
	NO_X	1.44 t/GWh	1.8t/GWh [2]	90-200 mg/Nm^3	Yes	See Note 4	Continuous		6% O_2

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	Particulates	4.23 mg/m^3	25mg/m^3 [3]	5-20 mg/Nm^3	Yes	Yes	Continuous BS EN13284-2	Monthly (same as permit) (BREF indicates daily average)	6% O_2
Annual Mass emissions (Cumulative to date Jan – Jul 2008) (excluding start-up and shutdown)									
Windshield 1 (AU1 + AU2 + AU3 + AU4 + AU5 + AU6) + A2 (Gas Turbines) + A X 1 + A X 2 (package boilers)	SO_2	11,565 tonnes	47,000tonnes (Installation 'A' limit (from 01/01/08) (See note 3)	N/A	Yes	See Note 4	Continuous	Annual mass emissions (same as permit)	6% O_2
		0.72 t/GWh (avg. release rate year to date)	1.8 t/GWh[1]	N/A	Yes				
	NO_X	22,201 tonnes	60,000[7] tonnes [4] (Installation 'A' limit (from 01/01/08) (See note 3)	N/A	Yes	See Note 4	Continuous	Annual mass emissions (same as permit)	6% O_2
		1.42 t/GWh (avg. release rate year to date)	1.8 t/GWh[2]	N/A	Yes				

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	Particulates	5.395 (avg. monthly concentration Jan-Jun)	25 mg/m^3[3]	N/A	Yes	Yes	Continuous BS EN13284-2	Monthly average (same as permit)	6% O_2
		251.15 (cumulative Jan – Jun)			No limit set in permit for annual particulate emissions (only monthly averages)				

Notes:

[1] An average of emissions data for SO_X and NO_X (tonnes) and particulates (mg/m^3) has been given above for the period Jan 2008 – Jul 2008 (i.e. average over 7 months). A full year's monitoring data was not available at the time of this assessment and as such a comparison with the annual emission limits set in the permit cannot be fully determined.

[2] Particulate limit: 25mg/m^3 with FGD plant in service, 50mg/m^3 with FGD out of service.

[3] 'A' limits are site specific and are effectively a harm limit in relation to local and national air quality standards. For this installation and two neighbouring power stations, this is based on data from 6 monitoring stations. The emission limit cannot be exceeded.

[4] Comparisons between annual mass emissions (permit and monitored data) and BAT-AEL concentrations could not be determined. In any case, the installation is not required to comply with concentration-based limits for these points.

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to water (based on emissions monitoring data for the period 01/06/2008 – 30/06/2008)									
W2 Outlet from FGD wastewater treatment (internal stream which joins W1 – not direct discharge to environment)	Flow	2,347 m3/d	10,000 m3/d	No BAT-AEL	Yes	No BAT-AEL	Continuous Electro-magnetic flow meter	Daily average	N/A
	Total Suspended Solids	7.9 mg/l	40 mg/l	5 - 30 mg/l	Yes	Yes	BS EN872	Monthly average of weekly spot sample	N/A
W1 (discharge to river)	pH	8.21	6-9	No BAT-AEL	Yes	No BAT-AEL	Continuous analyser	Monthly	N/A
	Temperature	19.84 C	30 C	No BAT-AEL	Yes	No BAT-AEL	Continuous analyser	Monthly	N/A
	Flow	86,599 m^3/day	302,400 m^3/day	No BAT-AEL	Yes	No BAT-AEL	Ultrasonic flow meter	Monthly	N/A
	Total Copper	0.1338 mg/l	0.2 mg/l	<0.5 mg/l	Yes	Yes	AWWA/APHA 20th edition 1999 (ICPMS)	Monthly average of weekly spot sample	N/A
	Copper (on filtered sample)	0.03572 mg/l	0.1[1]	<0.5[2] mg/l	Yes	Yes	AWWA/APHA 20th edition 1999 (ICPMS)	Monthly average of weekly spot sample	N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	Mercury (and its compounds expressed as Total Hg)	0.000147 mg/l	0.005 mg/l	0.01-0.02 mg/l	Yes	Yes	BS EN23506 (CVAF)	Monthly	N/A
	Cadmium (and its compounds expressed as Total Cd)	0.000995 mg/l	0.01 mg/l	0.05 mg/l	Yes	Yes	AWWA/APHA 20^{th} edition 1999 (ICPMS)	Monthly	N/A

Notes:

Averaging periods given above (actual applied at installation) meet the requirements of the permit. BREF indicates daily averages.

[1]This limit exists until 01/01/2008 or until completion and acceptance by Competent Authority of improvement condition (IC 10D), where the Operator is required to undertake a mass balance of copper in water for the installation. The report will contain measures that will be implemented to ensure there is no significant contribution to background concentration of copper in receiving waters from the installation.

[2] BAT-AEL provided for Copper, not for filtered Copper sample, therefore this BAT-AEL has been used.

Emissions to land

Not applicable

3.3.11 Combustion installations (coal and lignite) – summary

The assessment for this sector covered seven installations in seven Member States (Greece, Italy, Netherlands, Poland, Slovakia, Spain and the UK).

Overall quantitative conclusions regarding the implementation of the IPPC Directive are provided in Section 5 of this report and in Appendix H.

The setting of ELVs for this sector is complicated by the fact that installations fall within the remit of both the IPPC and LCP Directives. The LCP Directive has two implementation options for existing plants: the use of emission limit values or a National Emission Reduction Plan (NERP), as well as certain flexibilities and derogation possibilities. Furthermore, the installations covered include examples from the newer (EU-12) Member States, some of which have been granted temporary derogations for specific plants from either certain parts of the IPPC Directive or the LCP Directive.

The table below provides an indicative summary of the standards, BAT levels and emissions to air of three key pollutants from this sector (dust, NO_x and SO_2). In particular, it includes information on the relevant BREF BAT-AELs; the ELVs set in permit conditions; the ELVs set out in the LCP Directive; and actual installation performance. This information is only intended to be indicative of the broad ranges of these values and the reader is referred to the assessments for each installation for further information on the emissions from specific sources and the applicable permit ELVs, BAT-AELs and LCP Directive limit values[41].

Table 3.10 Indicative information on LCPs for emissions of certain air pollutants (BAT-AELs, permit ELVs, LCP Directive limits and actual installation performance)

Member State (1 installation each)	Pollutant	BAT-AEL (Note 1)	Permit ELVs (Note 1)	LCPD ELVs (Note 5)	Actual emissions (Note 1)
Greece	NOx	50-200 mg/m3 (daily)	500 mg/m3 (48h average and monthly average)	500 mg/m3	199 - 461 mg/m3 (6-8h interval samples over 3d; 30 min average for some points)
Italy	NOx	90-150 mg/m3 (daily)	100 mg/m3 (hourly)	200 mg/m3	N/A
Netherlands	NOx	90-200 mg/m3 (daily) (Note 2)	65-75 mg/m3 (yearly); 100 mg/m3 (daily); 200 mg/m3 (hourly)	200-500 mg/m3	75-158 mg/m3 (yearly average)

[41] Note that the BAT-AELs and LCP Directive limit values vary according to the age of the plant (new, existing), the size of the combustion plant, type of fuel used and other factors (specific details for each are provided in the detailed assessments.

Member State (1 installation each)	Pollutant	BAT-AEL (Note 1)	Permit ELVs (Note 1)	LCPD ELVs (Note 5)	Actual emissions (Note 1)
Poland	NOx	50-200 mg/m3 (daily)	500 mg/m3 (Note 7)	500 mg/m3	378-426 mg/m3 (6-month average) (Note 3)
Slovakia	NOx	50-300 mg/m3 (daily)	400-500 mg/m3 (daily)	600 mg/m3	119-726 mg/m3 (annual average)
Spain	NOx	90-200 mg/m3 (daily)	1,200-1,750 mg/m3 (Note 7)	500 mg/m3	905 mg/m3 (daily)
UK (Note 6)	NOx	90-200 mg/m3 (daily)	1.8 t/GWh 60,000t total mass	500 mg/m3	1.42 t/GWh 22,201t total mass
Greece	Particulates	5-20 mg/m3 (daily)	100 mg/m3 (48h average and monthly average)	50 mg/m3 (100 for certain types of solid fuels)	4.5 - 158 mg/m3 (6-8h interval samples over 3d; 30 min average for some points)
Italy	Particulates	5-10 mg/m3 (daily)	15 mg/m3 (hourly)	30 mg/m3	N/A
Netherlands	Particulates	5-20 mg/m3 (daily) (Note 2)	3-5 mg/m3 (yearly); 8 mg/m3 (daily); 10 mg/m3 (hourly)	50 mg/m3 (100 for certain types of solid fuels)	4-5 mg/m3 (yearly average)
Poland	Particulates	5-20 mg/m3 (daily)	100 mg/m3 (Note 7)	50 mg/m3 (100 for certain types of solid fuels)	93-133 mg/m3 (6-month average) (Note 3)
Slovakia	Particulates	5-20 mg/m3 (daily)	50-100 mg/m3 (daily)	50-100 mg/m3	24-280 mg/m3 (annual average)
Spain	Particulates	5-20 mg/m3 (daily)	50-280 mg/m3 (Note 7)	50 mg/m3 (100 for certain types of solid fuels)	90 mg/m3 (daily)
UK	Particulates	5-20 mg/m3 (daily)	25 mg/m3 (monthly)	50-100 mg/m3	3-8 mg/m3 (monthly)
Greece	SO_2	20-200 mg/m3 (daily)	400 mg/m3 (48h average and monthly average)	400 mg/m3	172 - 910 mg/m3 (6-8h interval samples over 3d; 30 min average for some points)
Italy	SO_2	20-150 mg/m3 (daily)	100 mg/m3 (hourly)	200 mg/m3	N/A
Netherlands	SO_2	20-200 mg/m3 (daily) (Note 2)	40-127 mg/m3 (yearly); 60 mg/m3 (daily); 189 mg/m3 (hourly)	200-400 mg/m3	89-166 mg/m3 (yearly average)
Poland	SO_2	20-200 mg/m3 (daily)	996 mg/m3 (Note 7)	400 mg/m3	538-802 mg/m3 (6-month average) (Note 3)
Slovakia	SO_2	20-400 mg/m3 (daily)	400 mg/m3 (daily)	400-1032 mg/m3	210-8,663 mg/m3 (annual average) (Note 4)
Spain	SO_2	20-200 mg/m3 (daily)	400-3000 mg/m3 (Note 4,7)	400 mg/m3	2424 mg/m3 (daily)

Member State (1 installation each)	Pollutant	BAT-AEL (Note 1)	Permit ELVs (Note 1)	LCPD ELVs (Note 5)	Actual emissions (Note 1)
UK (Note 6)	SO_2	20-200 mg/m3 (daily)	1.8 t/GWh 47,000t total mass	400 mg/m3	0.72 t/GWh 11,565t total mass

Notes:

1) Where there are several points at which emissions are measured and ELVs set, the range is quoted.

2) The BAT-AEL for one emission source is 5-10 mg/m3 for dust, 20-150 mg/m3 for SO_2 and 90-150 mg/m3 for NOx (new installation).

3) Range of values for different emission points. Most recent data have been taken.

4) Note that the highest emissions relate to emissions points that are considered as opted out of the requirements of the LCP Directive.

5) LCPD ELVs presented in this table do not include the specific ELVs related to plant operating under e.g. limited hours provisions. This should be taken into account in the comparison.

6) ELVs are not directly comparable with BAT-AELs because they are set on a different basis (concentration-based for the former and both total mass and mass per unit of electricity generation for the latter).

7) No averaging period given.

In interpreting the above table, it shouldbe noted that the LCPs in Greece, Spain and the UK form part of the corresponding NERP under the LCP Directive, with the Spanish installation having reduced operating hours for one unit in order to comply with the mass emission limits under the NERP. The Polish LCP has a transition period for complying with the LCP Directive under the Accession Treaty. The Slovakian LCP has one unit opted out (due to limited operating hours) under the LCP Directive and has a temporary derogation from the IPPC Directive under the Accession Treaty.

In one case in the table above (the UK), the ELVs set are based on mass emissions or emissions per unit of electricity generation and are therefore not directly comparable with the concentration-based BAT-AELs in the BREFs[42].

In relation to ELVs set in permits for emissions to air, there is significant variability amongst the installations with regard to the levels at which the ELVs are set and the basis for setting the ELVs. It is evident that the LCP Directive has been the main driver in defining NO_x, SO_2 and dust emission limit values for the majority of the installations assessed (with at least some ELVs set at the LCP Directive limit values for five of the seven installations). For each of the Member States, the approaches adopted were as follows:

- Greece: The installation is covered under the NERP under the LCP Directive. The permit includes ELVs for the main polluting substances, including concentration-based ELVs, effective from September 2007, for particulates, NO_x and SO_2 which have been based upon and are equal to the limit values in the LCP Directive[43]. The permit also includes mass emission limit values for SO_2 and NO_x,

42 The ELVs set are in line with the UK's guidance on BAT. The value of 1.8 tSO_2/GWh generated corresponds to 400 mg/m^3 and the value of 1.8 tNO_x/GWh generated corresponds to 500 mg/m^3, equivalent to the LCPD ELVs.

43 The permit ELVs are based directly on the limits in the LCP Directive (as incorporated into national legislation).

with revised mass emission values applicable following implementation of the NERP in August 2008 (though it was not clear during the assessment when these will be implemented in the permit and the relationship between these mass limits and the concentration-based limits was not clear).

- Italy: The ELVs for air emissions are more stringent than the LCP Directive ELVs and are generally consistent with the BAT-AELs, having been based on the LCP BREF. This is a new installation and was not operational at the time of the assessment.

- Netherlands: The ELVs appear to be consistent with the BAT-AELs for all relevant pollutants referred to in the LCP BREF and are hence lower than the ELVs in the LCP Directive.

- Poland: The installation has a transition period under the Accession Treaty for certain requirements of the LCP Directive. Consequently, certain permit ELVs are higher than the ELVs set in the LCP Directive (with all ELVs for LCP Directive pollutants above the BREF BAT-AELs).

- Slovakia: Some units of the combustion plant are "opted-out" under article 4(4) of the LCP Directive as they will not operate for more than 20,000 hours between 2008 and 2015. For those units that are opted out, permit ELVs have not been set, whilst for others permit ELVs appear to be in line with the ELVs in the LCP Directive (e.g. for NO_x and SO_2). For this installation, Slovakia has a temporary derogation from the requirement under the IPPC Directive to set ELVs based on BAT during a transition period set out in the Accession Treaty.

- Spain: The installation is covered under the Spanish NERP under the LCPD. Annual mass emission limits or bubble limits have been set which apply from 2008 to 2015, covering four production units (including the two main installations assessed). Concentration-based ELVs are also set in the permit for the two main installations. It is understood that BAT is not being applied in Group 1 (one of the two main production units) as a result of the decision to reduce the operating hours of the plant, allowing the overall annual mass emission limits set under the LCPD NERP to be met. For that unit, higher concentration-based ELVs have been set. For the second unit, ELVs less stringent than those in the LCP Directive have been set, with stricter ELVs (in line with the LCP Directive) applying following required improvements.

- United Kingdom: The installation is covered under the LCPD NERP and emission limit values are set as annual mass emissions. These include an 'A' limit (included in the table above) which cannot be exceeded and is intended to ensure compliance with ambient air quality standards, as well as a transferable (tradable) 'B' limit, also expressed in mass terms. BAT for this sector is determined at a sector level in the UK[44] and the permit also includes concentration-based ELVs for particulate emissions and limits on mass emissions per unit of electricity generation for NO_x and SO_2 (which are calculated by the competent authority to be equivalent to the LCP Directive ELVs).

Where installations are covered by a national emission reduction plan under the LCP Directive, this does not exempt those installations from needing to apply ELVs set out in accordance with the IPPC Directive. However, it is clear that in practice, it has affected the levels at which those ELVs are set by some competent authorities.

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[44] In this case, the permit conditions are based on the national competent authority's decision on the techniques and associated emission levels that are considered by them to represent BAT.

Likewise, although some combustion plant can "opt-out" under article 4(4) of the LCP Directive as they will not operate for more than 20,000 hours between 2008 and 2015, this provision applies without prejudice to the IPPC Directive (i.e. emission limit values or equivalent parameters should still be set according to the requirements of the IPPC Directive).

For emissions to water, there is generally much greater consistency between permit ELVs and BAT-AELs set out in the BREF. In the case of Italy, permit ELVs are based on general binding rules applicable to all IPPC installations (some of which include values higher than the BAT-AELs).

In relation to actual operation of the installations when compared to permit conditions (in particular ELVs) and to the BREF BAT-AELs, the following conclusions can be drawn:

- There is significant variability amongst the installations with regard to the averaging periods set in permits and used in practice (and in some cases such averaging periods could not be identified). In some cases, information on the averaging periods applying to permit ELVs and monitoring results was not provided. This makes a comparison between installations problematic.
- Monitoring undertaken by the operators appeared to comply with the conditions of the permit for five of the installations. The situation was mixed for one installation (due to malfunctioning of the continuous monitoring system) and the remaining installation (Italy) was not yet operational at the time of the assessment.
- Monitoring data for some of the installations (e.g. Greece, Spain) suggest that emissions have exceeded the permit ELVs in some cases.
- Based on the information made available, only one of the seven installations reported emissions that were all within the relevant BAT-AEL ranges.
- Inspections were conducted by the competent authority for the six installations that were operational at the time of the assessments. These were generally at a frequency of 1 to 3 inspections per year with less than one per year for one installation and around 4 per year for the remaining one.

3.4 Iron and steel production (sinter plants and associated blast furnaces)

3.4.1 Background to the sector

According to the 2001 BREF on iron and steel production, the production of crude steel in the European Union stood at 155.3 million tonnes in 1999, equivalent to about 20% of world production. In the EU about two thirds of crude steel was produced at this time via the blast furnace route at 40 sites and one third in 246 electric arc furnaces.

In 2008, crude steel production in the EU-27 was around 198 million tonnes (with levels having varied between around 192 and 210 million tonnes over the period 2003-07)[45]. In 2005, blast furnace (oxygen) steelmaking accounted for 61% of crude steel production, with the remainder accounted for by the electric arc process.

The main production steps in integrated steelworks include the following:

- Sinter plants;
- Pelletisation plants;
- Coke oven plants;
- Blast furnaces and
- Basic oxygen steelmaking including casting.

Electric arc furnace steelmaking is a different process.

As detailed in Section 2 of this report, it was agreed with the Commission that the assessment should focus on the blast furnace and sinter plant (given the complexity of some of the installations involved in this sector).

As such, the assessment does not include pelletisation plants, coke oven plants or basic oxygen steelmaking and casting. Sintering involves the physical and metallurgical preparation of the burden prior to the blast furnace.

The blast furnace and sinter plant can simplistically be described as follows[46]:

- Sinter plant – "A plant in which iron ore is crushed, homogenized and mixed with limestone and coke breeze and then cooked ("sintered") to form sinter which is the main ferrous component of blast furnace burden."
- Blast furnace – "A furnace used in integrated steelmaking in which coke and iron ore react together under a hot air flow to form liquid hot metal, also called pig iron."

3.4.2 Key environmental issues and BAT

The majority of the information below is taken from the BREF on the production of iron and steel (December 2001).

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45 http://www.eurofer.org/index.php/eng/Facts-Figures/Figures/EU-Crude-steel-production.

46 http://www.arcelormittal.com/index.php?lang=en&page=34.

The most important environmental issues of iron and steelmaking relate to emissions to air and solid wastes/by-products, with emissions from sinter plants dominating the overall emissions for most of the pollutants. Wastewater emissions from blast furnaces are one of the most relevant emissions to water in this sector.

For sinter production, the most relevant environmental issues are the off-gas emissions from the sinter strand, which contain a wide range of pollutants such as dust, heavy metals, SO_2, HCl, HF, PAHs and organochlorine compounds (such as PCB and PCDD/F).

The blast furnace consumes most of the overall energy input of an integrated steelworks.

The techniques considered to be BAT in the BREF are summarised in the following section.

3.4.3 Main emissions and levels associated with BAT

The tables below provide – for sinter plant and blast furnaces – a summary of the technologies considered to be BAT for each of the main processes, along with the achievable emission levels for the main pollutant emissions. These are based on the 2001 LCP BREF for iron and steel production.

Table 3.11 BAT and associated emission levels for sinter plant

Process	BAT	Parameter	BAT associated emission level
Emissions to air			
Waste gas de-dusting	Advanced electrostatic precipitation (ESP) Electrostatic precipitation plus fabric filter Pre-dusting (e.g. ESP or cyclones) plus high pressure wet scrubbing system	Dust emissions	< 50mg/Nm^3 achievable in normal operation. 10-20mg'Nm^3 achieved with fabric filter.
Waste gas recirculation (e.g. Emission Optimised Sintering EOS)	Recirculation of part of the waste gas from the entire surface of the sinter strand Sectional waste gas recirculation	-	-
	Application of waste gas recirculation Treatment of waste gas from sinter strand: - fine wet scrubbing systems (e.g. Airfine) - fabric filtration with lignite or coke powder	PCDD/F emissions	<0.4ng I-TEQ/Nm^3 if using wet scrubbing systems >98% reduction, 0.1-0.5ng I-TEQ/Nm^3 (fabric filtration/ lignite coke powder)
Minimising SO_2 emission	Lowering the sulphur input (use of coke breeze with low sulphur content & minimisation of coke breeze consumption; use of iron ore with low sulphur content) Wet waste gas desulphurisation (where environmental quality standards are not likely to be met)	SO_2	<500mg SO_2/Nm^3 <100mg SO_2/Nm^3

Process	BAT	Parameter	BAT associated emission level
Minimising NO_x emissions	Waste gas recirculation Waste gas denitrification (costly- applied only if EQSs not met) Regenerative activated carbon (RAC) process Selective catalytic reduction (SCR)	NOx	N/A
Heavy metals removal	Fine wet scrubbing system, or use of bag filter with lime addition Exclusion of dust from last ESP field from recycling to the sinter strand, dumping in a secure landfill, possibly after water extraction; precipitation of heavy metals.	Heavy metals	Can remove water-soluble heavy metal chlorides, especially lead chlorides with an efficiency of >90%
Emissions to water			
Emissions to water (not cooling water)	(*Only used when rinsing water used or wet waste gas treatment employed*). Heavy metal precipitation, neutralisation, sand filtration	TOC	< 20mg C/l and heavy metal concentrations < 0.1mg/l (Cd, Cr, Cu, Hg, Ni, Pb, Zn)
Waste			
Minimisation of solid waste	Recycling of by-products containing iron & carbon Minimising waste generation Selective recycling back to the sinter process Whenever internal reuse is hampered, external reuse should be aimed at. Controlled disposal in combination with the minimisation principle is the only other option.		
Hydrocarbon reduction	Lowering the hydrocarbon content of the sinter plant and avoidance of anthracite as a fuel will reduce oil content of recycled by-products/ residues.	Oil content	<0.1% (<20mg/Nm^3)

Table 3.12 BAT and associated emission levels for blast furnace

Process	BAT	Parameter	BAT associated emission level
Blast furnace	Blast furnace gas recovery	-	
	Direct injection of reducing agents, e.g. pulverised coal injection	-	
	Energy recovery of top BF gas pressure where prerequisites are present	-	
	Hot stoves	Dust, NOx	< 10mg/Nm^3 dust and of < 350mg/Nm^3 NOx (O_2 content of 3%)
	Use of tar free runner linings	-	

Process	BAT	Parameter	BAT associated emission level
Blast furnace gas treatment	De-dusting, i.e. dry separation technique (e.g. deflector) Scrubber; or wet electrostatic precipitator (EP)	Coarse particulate matter Fine particulate matter	< 10mg/Nm^3
Cast house de-dusting	Fabric filters or ESP	Dust emissions Fugitive emissions	1-15mg/Nm^3 5-15 g dust/ t pig iron
Blast furnace gas scrubbing wastewater	Reuse Coagulations/ sedimentation Hydrocyclonage of sludge with subsequent reuse of the coarse fraction.	Suspended solids	<20mg/l annual ave; 50mg/l single daily value
Minimising slag treatment emissions and slag to landfill	Granulation Condensation of fume if odour reduction is required. If pit slag – forced cooling with water should be minimised or avoided where possible and where space restrictions allow.	-	
Minimising solid waste/ by-products	*Descending order of priority* Minimising solid waste generation Recycling/ reuse, especially coarse dust from BF gas treatment and dust from cast house de-dusting Controlled disposal of unavoidable wastes	-	

Note: Determination of BAT should consider all aspects including minimisation of energy use. Where parameters (specific pollutant emissions associated with the techniques) are not specified in the BREF, these are marked with a dash ("-"); these techniques may, however, affect several environmental impacts (emissions of pollutants, energy use, etc.) as described in the BREF.

In relation to averaging periods for the above data, it was reportedly not possible to draw a conclusion within the Technical Working Group on what averaging periods should be used within the BREF for iron and steel production, though there was a recommendation that the BAT-AELs should be considered as daily averages unless otherwise stated (page 334).

3.4.4 Case study 1 – Italy

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/IT/29. The information in this table is based on the detailed assessment for this installation in Appendix C1. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation/application	The installation has been operational for approximately 120 years and its primary activities are permitted under IPPC for the following Annex 1 activities:

	▪ 1.3 Coke ovens; ▪ 2.1 Metal ore (including sulphide ore) roasting or sintering; ▪ 2.2 Production of pig iron or steel (primary or secondary fusion) including continuous casting with a capacity exceeding 2.5 tonnes per hour. The permit does not indicate any specified directly associated activities other than treatment of wastewaters and abatement of air pollutants, which are included within the primary support activities of the installation. A more detailed general description of the installation and its technical specifications were not available within the permit and due to the non-participation of the operator, it has not been possible to provide further details.
Type of permit/issue date	The permit was a new permit issued under decree D.Lgs. n. 59/2005 e s.m.i. (IPPC decree). The installation was previously regulated under an air-quality regime dating back to a decree made in 1988 (DPR 203/88). The permit was issued on 20th February 2008.
Basis of BAT determination	The primary basis of BAT determination in Italy are technical documents (MTDs) translating elements of the BAT reference documents (BREFs). These documents represent prescriptive legal requirements and are applicable at a national and regional level. The conditions contained within must be implemented by competent authorities when determining the conditions for an IPPC permit. At the time of permit application and determination, an MTD had not been formally issued to cover the activities of the installation and therefore the competent authority utilised the BAT comparison made by the operator (presented in their application) together with supporting additional information from the BREF on iron and steel. There are additional supporting legislative documents that are used by competent authorities as key references when determining, for example, ELVs. The primary document referenced by the competent authority is the Decree 2006 n. 152 No. 96L, which translates as ‘rules in environmental subjects’ and is a compendium of prescriptive emission limits and pollution prevention prescriptions covering all industry sectors and key pollutants. The ELVs contained within are based on European legislation and historic regulatory limits rather than BAT Associated Emission Levels (AELs).
Permit application	
Requirements of Article 6	The operator did not wish to participate in the assessment process or interview and therefore an assessment of the application was made at the interview with the competent authority, where it was viewed from the public records office. The application was complete and covered all elements required by Article 6 of the IPPC Directive.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit presents a clear assessment of actual operations against BAT as presented in the BREF on Production of Iron and Steel. Where the competent authority has determined that the installation is not applying BAT at present, the permit contains improvement conditions (ICs) in the form of an annex to the permit. These require the operator to implement such measures in accordance with a defined timescale (the completion date for the first set of improvements is December 2007 running through to December 2008). Through a combination of permit conditions and prescriptive improvement requirements, the permit addressed the key requirements of Article 3 (a), (b), (c) and (e). Where improvements are required, the permit clearly provides a specific date for realisation of those improvements and the competent authority demonstrated the rationale for setting these dates as short as possible whilst still enabling realistic implementation. **All improvements are due to be completed by end of December 2008**. Evidence gathered at the meeting demonstrated that the operator was on-schedule to complete the actions required by the permit. The permit did not contain any measures relating to energy efficiency (Article 3 (d)) or site closure measures (Article 3 (f)).

Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** ELVs to air are clearly set out in the permit (Part C) in sequential order by plant. **Water:** ELVs are not included in the permit directly but conditions relate to General Binding Rules that set out specific prescriptive limits for discharges to water. A check on these documents has been made during the interview and confirmed that such limits are in place however these have not been included in this assessment due to difficultly in obtaining copies of these legislative documents. **Land:** No emissions to land are permitted by this permit. **Waste:** No ELVs for waste disposal are included within the permit although there are general conditions relating to waste deposits, including the requirement to conform to the technical norms associated with waste management as cited in the regional legislation (this regional legislation has not been reviewed for the purposes of this study).. **Protection of soil and groundwater:** No ELVs to land are included within the permit although there are general conditions relating to waste deposits. **Transboundary considerations:** It was understood from responses made by the competent authority that transboundary issues were discussed at the internal determination meetings. Based on evidence of impact, transboundary issues were considered not to an issue for this installation and therefore the permit contains no such conditions and no transboundary consultation was undertaken. **Further equivalent technical parameters/measures:** Conditions are included in the permit to manage noise in accordance with the requirements and to the maximum levels specified in Italian law D.C.P.M. 01/03/1991.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** Where BAT-AELs have been detailed within the BREF on Production of Iron and Steel, the assessment shows that the majority of the permits ELVs (set for air emissions only in the permit) are commensurate with values within the BAT-AEL ranges. The competent authority has utilised what it feels are BAT-based conditions (or improvements) to reduce the main environmental pollutants to levels that are equivalent or close to BAT-AELs. The assessment has shown that not all ELVs are equivalent to the BAT-AELs set within the BREF on Production of Iron and Steel (blast and sinter plants). The ELVs on the blast furnace are based on the completion of improvements to realise decreased levels of emissions that are equivalent to those levels associated with BAT. For the blast furnace 'Caldaia CCT', the emission level of 50 mg/m^3 dust is greater than the BAT-AEL. For emissions where there is not a BAT-AEL presented in the conclusions within the 2001 BREF on Production of Iron and Steel, the competent authority indicated that ELVs have been taken from existing national legislation or from the previous environmental authorisation. Where BAT-based improvements would yield reductions in emissions of pollutants, the competent authority indicated that they reduced the ELVs to reflect the performance that could be achieved post-implementation of the measures. A key point raised by the competent authority is that following an assessment of environmental impacts, the permit requires lower ELVs on the key emissions against the main polluting substances (total dust (with the exception of the aforementioned blast furnace) and PCDD/Fs). Here, permit ELVs are at least equivalent to the upper end of the BAT-AEL range and in the case of PCDD/F, lower.
	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? There was evidence presented at the interview of consideration of local factors during permit determination. The installation has historically been the subject of significant environmental investigations, both by the competent authorities and public. In determining the permit conditions, the competent authority highlighted the assessments focused primarily on the technical abatement characteristics and the performance that could be achieved whilst recognising that the key impact upon the environment from the installation operations is emissions of fugitive dusts. However, the operator has historically argued that the technology and techniques used represents BAT, which the determination assessment completed by the competent authority confirmed. The emissions of PM_{10} are significant and cause for environmental concern and in response to this, where there was sufficient justification (including from a technical performance perspective), the competent authority highlighted that dust ELVs had been reduced from the previous authorisation. The example given by the competent authority was that BAT for fugitive dust emissions from the coke plant

	gates is 5% however the permit set a limit of 50 mg/m^3 in response to local public concerns and evidence of historic 'spikes' of dust as highlighted through ambient air quality monitoring reports. The evidence base (i.e. studies of actual environmental impact associated with elevated ambient particulate concentrations) at the time of determination of permit ELVs and conditions was considered by the competent authority to be insufficient to impose stricter conditions due to presence of other significant industrial sources of particulate matter in the locality. On-going assessments and monitoring will aim to further strengthen the case. See also evidence of factors not compatible with Directive below for additional detail.
	Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)? None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** There was evidence presented at the meeting of political factors influencing permitting procedure and directly influencing permit conditions that are not compatible with the BAT-based requirements within the Directive. The competent authority indicated that the coke plant operation had previously been stopped due to the plant being seized from the operator by the regional judicial court. The operator challenged this decision and it was overturned by another judicial review judge. The judge acknowledged the local concerns regarding air quality and environmental protection and imposed conditions upon the operator that the competent authority was required by law to impose through the IPPC permit. These conditions were not BAT-based and even though they represented stricter conditions than in previous authorisations, they were not as strict as the competent authority would have ideally liked based on the evidence of environmental impact on ambient air quality. The limits presented in the permit for the coke plant therefore do not, in the opinion of the competent authority, go far enough to mitigate the potential impacts of emissions on local air quality however the law requires that the ruling of the regional court must be upheld.
Use of relevant BREF documents in setting permit conditions?	**There was direct use of the BREF on Production of Iron and Steel by the operator and competent authority.** The BREF on Production of Iron and Steel was referenced by the competent authority in determining permit conditions, including ELVs. Usually, the Italian technical prescriptions provide legally binding requirements based on the information within BREF documents however in this instance, these sectoral documents were not yet available at the time of permit determination and therefore direct reference to the BREF was made. The competent authority indicated that such reference may be challenged by the operator as BREFs are not legally binding documents. However, in this case, no challenges were made to the competent authority's proposed plan of improvements to raise the standards of certain elements and technologies to BAT levels.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains a detailed series of conditions in Part D that address monitoring, control and reporting of emissions and operational parameters. The prescriptions include method, standard, frequency, emission point, and substances. Separate prescriptions with technical operational requirements are presented in Part D Table 4. The permit does not include direct reference to averaging periods for the monitoring of emissions but it is understood that by reference to the actual monitoring standard, this information is included by inference. This was not however confirmed with the operator due to their non-participation in the assessment. The permit contains conditions that require the operator to submit this information to the Environmental Inspectorate (ARPA) for compliance monitoring. ARPA is a separate body to the competent authority in this case. However, a copy is also sent to the competent authority on an annual basis. **Are the monitoring requirements sufficiently detailed?** Yes, the permit notes specific monitoring frequencies and standards which the operator must comply with. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** It is not clear that the monitoring requirements taken into account the principles of monitoring as expressed in the BREF; however reference is made to Italian legislative texts, where these principles and additional detail is contained. A check has not been made on these texts as part of this assessment. **Does the permit include information on duration in relation to monitoring requirements?** The permit includes requirements for the frequency of monitoring the permit does not contain requirements for averaging periods.

Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	No specific reference to abnormal conditions is made in the permit. In the event of abnormal operating conditions, the COMAH and/or accident plan would determine the procedures and actions that needed to be taken to prevent or minimise environmental impacts. This would not cover the normal start-up and shut-down periods and therefore full provisions in accordance with Article 9(6) have not been included in the present permit.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes – emission limit values for wastewater discharges are set using references to regional water authority limits presented in legally-binding decrees. Such rules are cross referenced within the permit.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The competent authority noted that there have been historic breaches of air quality standards with regard to concentration of particulate matter (PM_{10}, $PM_{2.5}$) in the locality of the installation. The operator currently applies BAT-based measures to control release of fugitive dusts and the permit makes provisions in the form of specific improvements to further strengthen the measures to control the releases and protect air quality standards. For example, CCTV has been installed on the coke gates and on the coal heaps to monitor visual emission of dust and take action as appropriate. The conclusion drawn following discussions with the competent authority was that BAT-based improvement conditions had been prioritised by the competent authority on the basis of significance of environmental impact and public lobbying. Whilst it was noted that certain aspects of the installation were equivalent or even better than BAT this was by no means a universal conclusion when considering the environmental impacts of, and emissions from, the entire installation.
Inclusion of information on period of validity of permit and when it will be reconsidered/updated (Article 13)	The permit is valid for a period of 6 years from the date of issue. The operator must prepare and submit, no later than 6 months prior to expiry of the current permit, a new application in order to obtain a permit renewal. Due to public objections and the intervention of the communal authority, a review of the permit conditions is now being undertaken and legal (court) proceedings are to be held shortly. The competent authority was unsure of the outcome of this objection although the outcomes may include permit suspension, revocation or a change of conditions.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes. The application and decision document are made available in paper format in an office providing public access during set hours. **Are monitoring records made available to the public?** Yes. Records are held by ARPA and made available upon request and are available in paper format within the public register of the inspectorate.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	Due to the non participation of the operator in this assessment, this information is not available. The competent authority indicated that competence for ensuring that the operator was undertaking monitoring in accordance with the permit requirements is the responsibility of ARPA, which did not participate in the meeting. The permit makes reference to national monitoring standards that detail the minimum requirements for emissions monitoring.
Operator's compliance with monitoring conditions	The competent authority believed that the operator was complying with the permit monitoring requirements.

Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	This information has not been made available.
Current emissions of key pollutants	Based on the monitoring data provided (February 2009), the ranges of emissions from the various sinter plant were as follows: • Dust emissions of 10.7 to 18 mg/Nm^3 • NO_x emissions of 180 mg/Nm^3 Corresponding emissions from the various blast furnace point sources were as follows: • Dust emissions of 1.5 to 2.3 mg/Nm^3 • NO_x emissions of 5 to 16 mg/Nm^3 • SO_2 emissions of less than 1 mg/Nm^3
Assessment of Installation performance against BAT	The data provided on emissions to air do not cover emissions of all pollutants and only relate to periodic measurements (taken on one day for each point source). Based on these data, the reported emissions are all lower than the corresponding permit ELVs and also lower than the BAT-AELs. The BAT-AELs do not have a corresponding agreed averaging period. An assessment of the PCDD/F emissions against the BAT-AELs given in the BREF has not been completed due to a lack of data.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	There is no evidence that the permit includes measures to demonstrate that at cessation of the installation activities, the site will be returned to a satisfactory state. The permit does not require the operator to produce a site closure report however a general clause is included in the permit (p30) that addresses site closure: “Once the production activities have come to a definitive end and if the need for doing so is present, the area where the plant stands must be remediated according to the requirement of the laws and regulations in force for land remediation and environmental recovery. This will consider potential permanent sources of ground pollution and also accident that might have occurred during production phase.”
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** ARPA undertakes the inspection of the site and is responsible for ensuring that the operator is complying with conditions and limits as defined within the permit. The competent authority indicated that they also receive copies of reports relating to compliance however they were unclear about how their role ensured compliance as it is primarily administrative. Contact was made with ARPA, who confirmed that they do inspect the site on a routine basis to check compliance. ARPA also confirmed that they receive and undertake desk-based inspections of the routine emissions monitoring results submitted by the operator in accordance with the requirements of the permit (though details of the monitoring data were not provided). **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** The competent authority indicated that they are responsible for taking formal enforcement if required. It was indicated at the meeting that the operator had failed to meet the submission deadline for an improvement action as detailed in the permit. In response to this, the competent authority took formal written notification to the installation operator – evidence for this was seen from the working file. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** Due to the non participation of the operator in this assessment, this information is not available. **Procedures used or action taken by the operator in the event of non-compliance** Due to the non participation of the operator in this assessment, this information is not available.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** ARPA undertakes the inspection of the site and from January 2009, will undertake a series of site visits to ensure compliance with permit conditions. ARPA have confirmed that they did not undertake any

information and to take samples	inspections in 2008. Due to the non participation of the operator in this assessment, information relating to whether they provide assistance to ARPA is not available.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Results of monitoring are held on the public register and are available upon request. No formal publication of the information is made by the competent authority or the operator.

Key observations from this case study assessment

- The operator made a formal application for an IPPC permit and this contained information that met the requirements of Article 6. Further formal requests for information were made by the competent authority during the determination period.
- The permit does not fully comply with Article 3 requirements. The permit is of an integrated type and covers most of the key elements required by Article 3; the exceptions being omissions of conditions that relate to energy efficiency (Article 3(d)) and site closure (Article 3 (f)).
- Where the competent authority has assessed the installation as not applying BAT at the time of permit application, the permit contains a series of improvement conditions that require the operator to raise the performance standard of the installation in line with BAT. These were due to have been completed by the end of 2008; however, given that the operator did not participate in the assessment, insufficient information was available to judge whether the improvements have been made in accordance with the dates specified within the permit
- The permit complies with the requirements of Article 9(3) as ELVs have been set in the permit for air emissions that cover the key pollutant species (i.e. SO_2, NO_x, PM_{10} (dust), PAH and PCDD/F). Water emission limits are set via a General Binding Rule. No further ELVs have been set (e.g. for land or waste).
- It was not clear from the permit what monitoring method and averaging period for evaluating emissions against limits have been set.
- The ELVs within the permit for point source releases of dust (50mg/m^3) are not set in line with BAT-AELs (<10mg/m^3). ELVs for other key air pollutants have been set at the upper end of or within the BAT-AEL range (e.g. NO_x, PCDD/F).
- Dust is a major issue for the surrounding receptors (including human habitation) and the competent authority has set concentration-based permit emission values for dust that are more specific than those required by BAT (e.g. BAT for fugitive emissions from coke gates is <5% however the permit sets a limit of 50mg/m^3).
- There was clear evidence of local factors influencing permit conditions and a very detailed environmental assessment being made prior to permit issue. A number of technical studies on impact of key pollutants (notably dust) was made prior to setting of permit conditions.
- The permit assessment demonstrated that sufficient information was included in the permit to meet the requirements of Article 9(5).
- Data provided on emissions to air do not cover emissions of all pollutants and only relate to periodic measurements (taken on one day for each point source). Based on these data, the reported emissions are all lower than the corresponding permit ELVs and also lower than the BAT-AELs. The BAT-AELs do not have a corresponding agreed averaging period.
- Where the operator had not made sufficient demonstration within the application that the installation is operating to BAT standards, the permit contains improvement conditions that require such changes as are necessary to raise the level of performance to that commensurate with BAT as given in the BREF on Production of Iron and Steel.
- There was evidence that requirements of Article 14 of the IPPC Directive were being met. The installation is subject to regular and routine inspections by the Italian Inspectorate (ARPA) and evidence was provided at the site visit of non-compliance events receiving adequate and appropriate action by the competent authority. The competent authority indicated that the operator was cooperative in submitting monitoring and performance data to the Inspectorate in accordance with the terms of their permit (though this information has not been provided).
- There was evidence of the requirements of Article 15 being met. Members of the public were given a suitable period of time to respond to draft permit conditions; consultation was undertaken and, where justified, permit conditions amended to reflect public concern.
- A legal challenge has since been made to the permit by the district authority in accordance with Article 16 of the Directive.
- The competent authority stated that no evidence had been presented that led to the conclusion that control of transboundary effects was required. It is understood that this aspect was assessed in accordance with Article 18 although no formal evidence for this has been seen during this assessment.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method (Permit)	Sampling/ measurement time (actual)	Reference Conditions (actual)
Emissions to air									
Emission n.5 Sinter Plant	Dust (total)	10.66 mg/Nm^3	50 mg/m^3	50 mg/m^3	Yes	Yes	EN 13284-1:2003	3 samples, 1h sampling time each sample (on 23/02/2009)	18.6% O_2 (permit states 273K, 5% O_2)
	NO_x	180.67 mg/Nm^3	600 mg/m^3	No BAT-AEL	Yes	N/A	D.M. 25/08/2000 All.I		
	PCDD/F	No data	0.4ng TEQ/m^3	0.1-0.5ng TEQ/m^3	No data	No data	UNI EN 1948 Parte 1, 2, 3	N/A	
Emission n.7, Sinter Plant	Dust (total)	17.95 mg/Nm^3	50 mg/m^3	50 mg/m^3	Yes	Yes	EN 13284-1:2003	3 samples, 1h sampling time each sample (on 23/02/2009)	No data (permit states 273K, 5% O_2)
	NO_x	No data	600 mg/m^3	No BAT-AEL	No data	No data	D.M. 25/08/2000 All.I	No data	
	PCDD/F	No data	0.4ng TEQ/m^3	0.1-0.5ng TEQ/m^3	No data	No data	UNI EN 1948 Parte 1, 2, 3	No data	
Emission n.36 Sinter Plant	Dust (total)	0.90 mg/Nm^3	50 mg/m^3	50 mg/m^3	Yes	Yes	EN 13284-1:2003	3 samples, 1h sampling time each sample (on 23/02/2009)	No data (permit states 273K, 5% O_2)

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method (Permit)	Sampling/ measurement time (actual)	Reference Conditions (actual)
	NO_x	No data	600 mg/m^3	No BAT-AEL	No data	No data	D.M. 25/08/2000 All.I	No data	
	PCDD/F	No data	0.4ng TEQ/m^3	0.1-0.5ng TEQ/m^3	No data	No data	UNI EN 1948 Parte 1, 2, 3	No data	
Emission n.9 Blast Furnace	Dust (total)	2.29 mg/Nm^3	10 mg/m^3	<10 mg/m^3	Yes	Yes	EN 13284-1:2003	3 samples, 1h sampling time each sample (on 23/02/2009)	3.4% O_2 for dust and 3.0% for others (permit states 273K, 3% O_2)
	NO_x	16.41 mg/Nm^3	350 mg/m^3	<350 mg/m^3	Yes	Yes	D.M. 25/08/2000 All.I		
	SO_2	<1 mg/Nm^3	800 mg/m^3	No BAT-AEL	Yes	N/A	D.M. 25/08/2000 All.I		
Emission n.38 Blast Furnace	Dust (total)	1.49 mg/Nm^3	50 mg/m^3	<10 mg/m^3	Yes	Yes	EN 13284-1:2003	3 samples, 1h sampling time each sample (on 23/02/2009)	3.4% O_2 for dust and 3.0% for others (permit states 273K, 3% O_2)
	NO_x	5 mg/Nm^3	350 mg/m^3	<350 mg/m^3	Yes	Yes	D.M. 25/08/2000 All.I		
	SO_2	<1 mg/Nm^3	800 mg/m^3	No BAT-AEL	Yes	N/A	D.M. 25/08/2000 All.I		
Notes: Detail of prescribed averaging periods was not provided in the permits. It was reportedly not possible to draw a conclusion on what averaging periods should be used within the ISP BREF (page 334).									
Emissions to water									
Notes: No ELVs are given in the permit on water emissions. The permit references GBRs (D.M. 367/2003) that set prescriptive ELVs.									
Emissions to land									
Notes: No emissions to land are permitted.									

3.4.5 Case study 2 – Netherlands

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/NL/02. The information in this table is based on the detailed assessment for this installation in Appendix C2. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation/application	The installation is an integrated steel production plant comprising 3 main processes: • Production of pig iron from iron ore and coke (coke oven plant, sinter plant, pelletisation plant and blast furnaces) • Production of steel out of pig iron (oxygen steel plant) • Further treatment of steel (cold and hot rolling mills, surface treatment) The site produces approximately 7.5 million tonnes of steel/year. The assessment has mainly focussed on the sinter plant and blast furnace.
Type of permit/issue date	The permit application was submitted in 2004 in order to obtain a complete revision of the existing permits, as required by the Competent Authority. The permit was issued on January 16, 2007. Due to appeal, a modified permit was delivered on October 28, 2008. Both permits have been assessed.
Basis of BAT determination	For the IPPC installations in the Netherlands, BAT is determined by the BREF documents. Guidance on BAT-determination is foreseen (though the timescales are not known). For other activities, BAT is determined by GBR. The BREFs are normally transposed into the GBR. In cases where both BAT-AELs and GBRs apply, the most stringent of the two is transposed as permit conditions.
Permit application	
Requirements of Article 6	The permit application meets all of the requirements of Article 6 with the exception of measures to restore the site to a satisfactory state after cessation of the activities, which are covered by GBR.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** All items of Article 3 of the Directive are covered in the permit: pollution prevention measures, measures to ensure that no significant pollution is caused, waste avoidance, recovery and disposal measures, energy efficiency measures and measures upon cessation of the activities (the latter governed by GBRs). According to operator and CA, there is a frequent dialogue where all issues can be discussed. The operator feels that, due to the split responsibilities for permitting (2 CAs), an integrated approach to addressing environmental issues is hampered and this also reportedly complicates discussions.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	ELVs are set for the total load to air (mass emissions) from the activities on the site for SO_2, lead and dust. Concentration ELVs are set for the individual emission sources to air (e.g. for the blast furnace and the sinter plant). The permit also sets a limit value for the contribution of emissions to NOx ambient air concentrations in the vicinity of the plant due to activities of the installation. ELVs for discharges to water are set in a separate permit.

Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** Yes. The permit elaborates on the way BAT has been taken into account when setting the ELVs. Several of the permit ELVs are set at a level in line with the BAT-AELs, though there are also several permit ELVs that are somewhat higher than the BAT-AEL ranges.
	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? Local environmental condition has been taken into account when setting the ELVs to air. The feasibility of setting more stringent ELVs is weighed against the plant's technical capabilities to reach these more stringent ELVs. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** No
Use of relevant BREF documents in setting permit conditions?	The relevant BREFs are directly mentioned in the permit application and the decision document. Due to an appeal, the high court has ruled in favour of one technology for emission reduction measures (fabric filters) because this technology allowed more stringent ELVs to be met while other technologies are also considered in the BREF document as being BAT, although local environmental conditions and environmental quality standards did not require the setting of more stringent ELVs. As a result of this ruling, the company has been obliged to apply this technology.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit specifies monitoring methodology and frequency for emissions to air. No detail on the averaging periods to be applied is provided in the permit for air emissions (which are understood to be set out in GBRs). Averaging periods are specified for water emissions. **Are the monitoring requirements sufficiently detailed?** Yes, parameters and frequency are specified in detail. For monitoring methodology reference is made to GBRs. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** Monitoring methodology is prescribed by GBRs but these have not been examined.. **Does the permit include information on duration in relation to monitoring requirements?** Yes
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Measures relating to conditions other than normal operations are governed by GBRs.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes. Abnormal operating conditions and measures to be taken in case of cessation of activities are governed by GBRs. ELVs for emissions to air for combustion plants/boilers are also governed by GBR. In the Netherlands, GBRs generally apply unless they are overruled by specific conditions in the permit. The permit only makes reference to the GBRs rather than including their provisions directly.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The emission contribution for NOx (impact on ambient air quality) due to the plant's activities is also limited through the permit. This does not immediately imply the setting of more stringent ELVs for specific sources but obliges the operator to further reduce emissions from certain sources in case the plants' contribution to the ambient air quality is exceeded. In addition, a more stringent ELV for discharges of SO_2 to air has been set because of the very tight emission ceiling under the NEC Directive for this pollutant in the Netherlands.

Inclusion of information on period of validity of permit and when it will be reconsidered/updated (Article 13)	The permit has no expiry date but there is a policy for the Competent Authorities to evaluate the need for an update every 5 years. In case of major modifications, an update of the permit is also required.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The permit application has been subject to public participation and has been made available to the public. The permit is available to the public upon request. **Are monitoring records made available to the public?** Monitoring records are made available to the public in the annual environmental report. Other issues which are enforced in the permit (research, measurements and calculations) are reported to the Competent Authority first and will have to be included in the annual environmental report.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The emissions of some key pollutants from the most relevant sources is monitored continuously, while for other sources the frequency of monitoring ranges from a number of times a year to once every couple of years, depending on pollutant and the total load from that particular source.

Sinter plant emission points	**Parameter**	**Frequency**
ESP (roomdedusting) EL 321	dust	continuous
	Metals	2/ year
High pressure wet scrubber EL 312	dust	continuous
	SO_2	continuous
	NO_x	1/ year
	VOS	1/ 3 years
	CH_4	1/ 3 years
	CO	1/ year
	HF	1/ year
	Hg (gas)	1/ year
	Metals	2/ year
	PCDD/PCDF	2/ year
Off-gas from sinter installations EL 331+332+333	dust	1/ 3 years
	Metals	1/ 3 years
	NO_x	1/ 4 years
	Hg	1/ 3 years
	PCDD/PCDF	2/ year
	Hg (gas)	2/ year
Blast furnace emission points		
Hot stoves EL 15.6 – 15.7	NO_x	1/ year
Cast house de-dusting EL 30.6-30.7	SO_2	1/ 3 years

Operator's compliance with monitoring conditions	The monitoring requirements specified in the permit are complied with.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	No information was provided in order to be able to consider the emissions prior to the implementation of the IPPC permit.
Current emissions of key pollutants	This information is provided within the table below. The data in this table have been provided by the operator.

Assessment of Installation performance against BAT	There were exceedances found of the permit ELVs for the dust concentration in the off gas from the sinter plant and for the ELVs of Cd, Kjeldahl-N and F in discharges to water. All other emission sources to air and water comply with permit ELVs and BAT-AELs.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	There is a general obligation in the Netherlands to investigate the condition of the soil upon cessation of the activities. Dialogue with the CA is required before an installation is removed in order to guarantee the return of the site to a satisfactory state.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** • Control of the emission monitoring performed by the operator • Inspections are performed in accordance with a yearly program which fixes themes and frequency of site visits for each production unit • Spot sampling of emissions to air and water • Control of the reported data for the yearly environmental report **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** To date, all non-compliance issues have been settled after the writing of a formal enforcement letter. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** • Every production unit has a management system which fixes daily or weekly visits through this part of the site. During the visit, an inspection list is checked. • Self monitoring of emissions and discussion of exceedances with the management **Procedures used or action taken by the operator in the event of non-compliance** Taking the necessary steps to resolve the problem as soon as possible.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** There are 7 planned inspections for each production unit (e.g. sintering plant, blast furnace, hot rolling, oxygen steel plant) each year.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Monitoring records are made available to the public in the annual environmental report,. These are written by the operator. Yearly loads to the environment of large installations are also made publicly available on the internet (emissieregistratie.nl).
Key observations from this case study assessment	
The draft permit has been appealed several times leading to a permitting procedure that has lasted 3 years. There has been an appeal of the permit itself upon which the high court has ruled, which has lead to the issuing of a new permit with altered permit conditions. The company and the CA started the BAT evaluation in 2000, as part of the preparation of a permit application. The final version of the BAT evaluation was completed in June 2006. The BAT evaluation for IPPC-relevant activities was based on the BREF documents. All relevant issues (article 3 of the Directive) are covered in the permit requirements. According to operator and CA, there is a frequent dialogue where all issues can be discussed. The operator feels that, due to the split responsibilities for permitting (2 CAs) an integrated approach to addressing environmental issues is hampered and this also reportedly complicates discussions. The permit conditions and in particular the ELVs are demonstrably based on BAT. In terms of current performance, the majority of emissions comply with the permit-ELVs and are in line with BAT-AELs where these are available. There has been an exceedance of the permit ELV for air emissions of dust (off-gas from sinter installations) and for emissions to water of Cd (high pressure scrubber) and F (scrubber) and a slight exceedance of the permit ELV and BAT-AEL for Kjeldahl-N. There were a few particular issues which arose while setting the permit conditions and have implications for the setting of permit ELVs in line with the BAT-AELs. For example: ▪ Contrary to the opinion of the CA and the operator, the high court reportedly suggests that certain BAT from the BREF should be	

considered preferable to others.

- The validity of the BREF document has been questioned by both the Competent Authority and the operator because the document was more than 10 years old at the time of the high court appeal of the permit.
- According to the operator, the stringent SO_2 ceiling for the Netherlands in the NEC Directive has led to the enforcement of a number of additional SO_2 emission reduction measures that are more stringent than BAT, depriving the operator of the flexibility to reduce emissions in the most cost-efficient way.

The permit conditions (e.g. ELVs) are demonstrably based on BAT. In terms of current performance, the majority of emissions comply with the permit-ELVs and are in line with BAT-AELs where these are available. Due to the complex nature of this plant a direct comparison of individual unit ELVs for discharges to air and water with BAT-AELs is problematic.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods (significant further data is provided in the detailed assessment in Appendix C2)

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. Units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Installation wide load	SO_2	3,557 tonnes/yr	4,400 tonnes/yr	-	Yes	N/A	No data	No data (see notes)	No data
	Pb	28,651 tonnes/yr	32,000 tonnes/yr	-	Yes	N/A	No data	No data	No data
	Dust	1,666 tonnes/yr	1,750 tonnes/yr	-	Yes	N/A	No data	No data	No data
Sinter plant (with bypass and Emission Optimised Sintering)	Dust	289 mg/Nm³	250 mg/Nm³	<50 mg/m³ (10-20 mg/m³ with fabric filter)	No	N/A	No data	No data	12% O_2
Sinter plant - High pressure wet scrubber	VOC	29 mg/Nm³ 18 kg/hr	110 mg/Nm³ 70 kg/hr	-	Yes Yes	-	Maximum value	No data	12% O_2
	CO	10,100 mg/Nm³ 5,961 kg/hr	14,500 mg/Nm³ 9,150 kg/hr	-	Yes Yes	-	Maximum value	No data	12% O_2
	HF	0.3 mg/Nm³ 0.19 kg/hr	1 mg/Nm³ 0.7 kg/hr	-	Yes Yes	-	Maximum value	No data	12% O_2
	HCl	0.5 mg/Nm³ 0.32 kg/hr	1 mg/Nm³ 0.7 kg/hr	-	Yes Yes	-	Maximum value	No data	12% O_2

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. Units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Blast furnace – Bunkering de-dusting	Dust	10 mg/Nm³ 0.6 – 0.65 kg/hr	15 mg/Nm³ 1 – 1.2 kg/hr	-	Yes Yes	N/A	Maximum value	No data	No data
Blast furnace – Hot stoves	Dust	< 1 mg/Nm³ 0.12 kg/hr	5 mg/Nm³ 0.6 kg/hr	10 mg/Nm³	Yes Yes	Yes N/A	Maximum value	No data	No data
Steel plant – BOF gas recovery	Dust	9 – 33 mg/Nm³	50 mg/Nm³	-	Yes	-	Maximum value	No data	No data
	CO	530 kg/load	750 kg/load	-	Yes	N/A	No data	No data	No data
Notes: Averaging periods were not available in the permit or monitoring data. It was reportedly not possible to draw a conclusion on what averaging periods should be used within the ISP BREF.									
Emissions to water									
Sinter plant high pressure scrubber	Dioxins	0.016 ng/l	1.7 ng/l	-	Yes	N/A	No data	No data	No data
	Cd	0.404 mg/l	0.02 mg/l	-	No	N/A	No data		No data
Sinter plant fluoride scrubber	SS	25.8 mg/l	50 mg/l 30 mg/l	-	Yes Yes	-	No data	Maximum Average	No data
	COD	66.5 mg/l	160 mg/l 100 mg/l	-	Yes Yes	-	No data	Maximum 10 sample average	No data
	Kj-N	16.5 mg/l	10 mg/l	15 mg/l	No	No	No data	10 sample average	No data

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. Units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	F	1630	1500	-	No	-	No data	Maximum	No data
	Cd	0.0028 mg/l	0.01 mg/l	-	Yes	-	No data	Maximum	No data
	Hg	0.0063 mg/l	0.01 mg/l 0.0025 mg/l	-	Yes No	-	No data	Maximum 10 sample average	No data
	As	0.0993 mg/l	0.1 mg/l 0.05 mg/l	-	Yes No	-	No data	Maximum 10 sample average	No data
Emissions to land									
Notes: Not applicable.									

3.4.6 Case study 3 – Slovakia

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/03/SK. The information in this table is based on the detailed assessment for this installation in Appendix C3. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation/application	The installation is a very large fully integrated, flat-rolled steel production site. The installation operates a wide range of integrated processes including: ▪ coking plant supplying blast furnaces and coke product for export; ▪ 3 blast furnace units ▪ 4 sintering lines ▪ hot-rolling mill ▪ cold-rolling mill ▪ surface treatment units and finishing plants ▪ integrated services and facilities (power units, engineering, wastewater treatment, technical gases provision) The installation's history dates back to 1959 with the first operational blast furnaces coming on-line in 1965. Since 2000, the installation has been subject to progressive modernisation and upgrading of plant and retrofitting of environmental protection abatement equipment. The current environmental investment programme is €700M and the installation is due for next phase after 2010. The installation operates 19 different IPPC permitted facilities including metal ore production (2.1), production of pig iron (2.2), processing of ferrous metals (2.3 a/b), surface treatment of metals (2.6), waste incineration (5.1), landfills >10 tonnes/day (5.4), surface treatment with solvents (6.7) and production of carbon or electrographite (6.8). For the purposes of this assessment, the focus is on the integrated blast furnace and sinter plant. The operator submitted applications for IPPC permits to operate these existing installations under transitional arrangements. Applications were made in 2004 to the Slovak Environmental Inspectorate (SZIP), who are the competent authority for IPPC in the Slovak Republic.
Type of permit/issue date	The installation currently holds separate permits to operate the blast furnace plant (Vysoké pece) and the sinter plant (Príprava výroby). The IPPC permits were issued under transitional arrangements from an existing regulatory regime. The blast furnace permit was issued on 14/10/2006 and the sinter plant permit on 28/07/2005. Since permit issue, there have been several amendments made to the permits in light of changes in process technologies and implementation of updated automatic monitoring systems.
Basis of BAT determination	The key piece of information relied upon in the determination of BAT is the IPPC Act 245/2003, specifically paragraph 5 and Annex 3. There is guidance on the Slovak Environmental Inspectorate (SIZP) website that BREF documents can form part of the process of IPPC permit determination. There is also published guidance on assessing IPPC applications that are made using the standard format 'template' available from the Ministry of Environment website. The inspector also noted that several IPPC training events have been held to ensure that competent authorities are suitable qualified to assess and determine permit conditions.

Permit application	
Requirements of Article 6	The applications made by the operator contained all the key elements required by Article 6 although the early applications lacked some specific technical detail. The competent authority stated that following submission of the first application, requests for additional information were made, particularly on the storage of processed materials in the sintering plant. Whilst the first application did contain all the relevant sections required by the Slovakian GBR on applying for an IPPC permit, the additional requests were necessary in order to determine the permit.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit has been assessed as having sections that cover the main elements required by Article 3. It is noted that these two particular permits contained a more extensive volume of information regarding the monitoring measures and standards relative to other Slovak permits.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** ELVs have been included in the blast furnace and sinter plant permits for all key emission points. ELVs are set out in GBR 706/2002 Z.z. and competent authorities must set ELVs at least as strict as those given in this GBR. Stricter limits may be set if there is considered to be a need for them on the basis of decisions made in conjunction with other competent authorities responsible for air and water protection. **Sinter Plant** In addition to the key permit ELVs for the primary emission from the 4 sinter belts, the permit also includes limit values for key air pollutants for a number of minor emission sources, for which the following limits are set: • Particulates = 50 mg/m^3 • Heavy metals - $As+Cr_6+Co+Ni$ = 1 mg/m^3 • Heavy metals - $Sb+Sn+Cr+Mn+Cu+Pb+V+Zn$ = 5 mg/m^3 These limits must be met by all minor sources individually; the permit does not reference use of the bubble concept. **Water:** ELVs for emissions to water are not set within the blast furnace or sinter plant permits as there are no direct discharges from either of these facilities to surface or groundwater. All liquid effluents are routed through to the central effluent treatment plant, which has limits specified for key pollutants. **Land:** No ELVs have been set in the permit for emissions to land. **Protection of soil and groundwater** No ELVs have been set. **Waste** No ELVs have been set for waste although several conditions relate to the GBR 223/2001 Z.z. on management of wastes and conditions in the permit require the operator to minimise wastes and recover them where practicable. **Transboundary considerations** It is understood that the procedure for taking into account transboundary pollution was done in accordance with Article 17, although the competent authority were not clear which Member States were consulted as this was co-ordinated centrally from Bratislava. There is a section in the permits for conditions on transboundary impacts however there have been no specific conditions set for these permits. **Further equivalent technical parameters/measures** have been set for: These have not been used in the permits.

Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** **<u>Sinter Plant</u>** The key environmental aspects of sinter plant operations are emissions of dust, heavy metals, NO_x, SO_2 and dioxins. Maximising recovery of heat is also considered to be BAT. The permit contains conditions that seek to ensure protection of the environment through ELVs set using the GBR 706/2002 Z.z. Based on a comparison of the permit limit values against BAT-AELs (where conclusions have been reached and reported in the BREF on Iron and Steel Production), the only limit that is set currently within a defined BAT-AEL range is that for SO_2. Other ELVs are set higher than BAT-AEL ranges. It is particularly relevant to this assessment that no permit ELV has been set for dioxins and furans; one of the key environmental pollutants from the materials preparation for the integrated steel making processes. It would be expected that an emission limit should be imposed by the competent authority. **<u>Blast Furnace Plant</u>** The key environmental emissions associated with the blast furnace are emissions of dust, treatment of fumes and managing slag by-product. The permit contains conditions that relate to the recovery and management of wastes in accordance with BAT. Permit ELVs for the main emissions set in the permit are all set above BAT-AELs (where conclusions on BAT have been presented). **<u>Conclusion</u>** The permit decisions show how BAT has been taken into account by the competent authorities. The introductory sections of the permit detail very clearly the operational parameters that the operator is using to ensure effective reduction of environmental risk and impact and this information has been utilised in such a judgement. Based on the data provided on operational performance by the operator, the levels of achievable emissions are understood to be much lower that the present ELVs within the permits. An example of this is contained on page 5 of the blast furnace permit, which clearly quotes that the 3-stage scrubbing system employed to clean off-gases from the blast furnaces achieves staged results for particulate concentrations of 15mg/m^3 (max stage 1) down to 5mg/m^3 (stages 2 and 3). The conclusion, therefore, is that whilst the plant may, in some cases, be utilising BAT in order to minimise its environmental impacts, the permit ELVs have not been set having regard to that level of performance; rather instead based on activity-specific GBRs. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** At permit determination stage, there is clear evidence and a legal requirement that competent authorities (though not necessarily the Inspectorate) assess the emissions from the installation in light of local environmental conditions in order to ensure no breach of national or regional air and water quality standards. Key local environmental conditions and priorities are taken into account through the District Environmental Office (local surface waters competent authority) or Slovak Hydrometeorological Institute (air and water quality). Based on the response from this assessment, unless there is a specific environmental requirement to set stricter ELVs, these are transposed directly from GBR 706/2002 Z.z., which details the emission limit values by industrial Annex 1 activities. The GBR is updated by the Ministry of Environment in accordance with EU Directives and EQSs. However, in this instance, the competent authority has not justified a requirement to set stricter limits and therefore the ELVs do not directly show evidence of being set based on the specific technical characteristics, geographic location or local environmental conditions. **Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?** None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** None observed.

Use of relevant BREF documents in setting permit conditions?	The response from the competent authority on this matter was that BREF documents had been taken into account during development of the GBRs (and subsequently amended). It remains unclear as to what extend the Ministry of Environment have adopted the BREF BAT-AELs within GBRs. There was no direct use of the BREF on Production of Iron and Steel by the environmental Inspectorate during determination as the operator has made a very direct comparative assessment within their applications using key BREF information and references.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains a specific section dealing with monitoring and reporting of emissions data. There are tables within both permits that detail the measurement and frequency of the monitoring required, the evaluation process (analytical methods) and a requirement to supply monitoring data to the competent authority. **Are the monitoring requirements sufficiently detailed?** There were discrepancies between the level of information on monitoring between the blast furnace and sinter plant permits in this assessment. Both permits contained the basic information and qualifying statements on how the monitoring should be performed. The blast furnace permit contained far more detailed information on the analytical methods and international standards that should be used for each pollutant to be monitored. The sinter plant permit referenced the GBR 408/2003 Z.z. on monitoring that holds the information on monitoring methods and standards that must be followed by operators. In essence, both permits contain detailed information but one uses referencing and the other transposes the detail into the actual permit. **Do the monitoring requirements take into account the details contained within the BREF documents?** There is evidence to suggest that some of the information specified in the BREF document on monitoring techniques have been taken into account when determining the monitoring conditions. There has been a focus on monitoring of the pollutant with the most significant impact (dust) borne out by the requirement to install continuous monitoring systems that operate on 15 minute averages. **Does the permit include information on duration in relation to monitoring requirements?** The GBR on monitoring specifies the periods that must be observed by operators when not monitoring continuously. These are 3 or 6 yearly intervals, which result in a significant level of uncertainty regarding compliance based on assessment of monitoring data alone. This therefore puts greater emphasis on the Inspectorate to ensure compliance through other means, including direct inspection. In all cases, the permits reference the duration of the monitoring averaging period or refer out to GBR 408/2003 Z.z.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	The permit contains a condition relating to the provision of operational procedures to limit pollution from the installation in the event of abnormal or fault conditions. Regulation 706 covers the measures that are required and the permit references the proposals made by the operator in their applications.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes. MŽP SR č.706/2002 Z.z. is used to set the ELVs for permits and contains strict limits according to categories of industrial activities. MŽP SR č.1/2003.z and MŽP SR č.408/2003 relate to the requirements that the operator must follow with regard to conducting emissions monitoring. As is common in a number of IPPC permits issued in Slovakia, some GBRs are referenced within the permit whereas for others the actual text of the GBR is copied into the permit itself.

Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The response by the competent authority indicated that regional and local environmental conditions are assessed using ambient monitoring stations and controlled water monitoring networks. Relevant standards are reviewed in light of any application for an IPPC permit. If, on the basis of the assessment, there is a justification (for example a breach of EQS), the competent authority has the power to set stricter ELVs at such a level that would ensure adequate environmental protection and compliance with the EQS. For the two permits being considered, there were not considered to be any EQSs that required stricter conditions than those achievable through the use of BAT.
Inclusion of information on period of validity of permit and when it will be reconsidered/updated (Article 13)	IPPC permits are valid for a maximum period of 8 years from issue date and permissions related to water emissions are valid for only 3 years, after which time the operator must re-apply to the competent authority. There have been a number of amendments made to all the permits issued by the competent authority for this installation that reflect changes made in accordance with proposed improvements in accordance with the operator's investment programme and to implement BAT.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes, the application is available upon request. Since 2005, the IPPC permits and subsequent amendments are available from the website of the Slovak Environmental Inspectorate in electronic downloaded files. The main permit for the sinter plant is not currently available electronically but is available upon request. **Are monitoring records made available to the public?** Monitoring records are understood to be available from the Inspectorate upon request however the assessment team met significant difficulties in obtaining relevant monitoring data from the competent authorities or operator.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The competent authority indicated at interview that the operator presently complies with all monitoring conditions, including improvements (e.g. continuous monitoring). The operator was unable to participate in the assessment of this permit and therefore no detail has been given on actual monitoring.
Operator's compliance with monitoring conditions	The operator undertakes and publishes a substantial amount of monitoring data in accordance with the requirement of both the permit conditions and the freedom of information act. A report is published on a monthly basis that contains detailed evaluation of monthly monitored values against permitted emission limits. The report is presented in both Slovak and English languages and for August 2008 indicates that compliance with all limits and monitoring requirements has been achieved. A full annual assessment has not been conducted.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	This data was not available from the operator or competent authority despite repeated requests.
Current emissions of key pollutants	This data is presented in the table below and a comparison against BAT is given below.

Assessment of Installation performance against BAT	On the basis of the data submitted by the competent authority, the following conclusions have been reached: **Sinter Plant** All reported values are below permitted limits and therefore comply with the ELVs. Volatile organic compounds are all at or below the BAT-AEL range upper value. Particulate emissions are above BAT-AEL values but not by a significant margin. There are no BAT-AELs for CO given in the Iron and Steel Production BREF. However, the results reported are high (although still within the permitted limit of 6000mg/m^3). It is noted that the results for CO are relatively consistent across the four belts, which can be interpreted to demonstrate a high degree of performance optimisation. Both NO_x and SO_2 reported values are consistent across the four sinter belts and although there are no conclusions on NO_x BAT-AELs within the BREF (2001), the reported emissions of SO_2 are all below the BAT-AEL value of 500 mg/m^3. Emissions of heavy metals and other compounds are all reported as being within permitted values; however no clear conclusions on BAT-AEL values are available within the BREF. **Blast furnaces** For particulate matter, the reported values are all within permitted levels; however, the results from the AMS (Automatic Monitoring System) (VP2 and VP3) have recorded values that are above the BAT-AEL (although no indication of averaging periods was provided and therefore it is difficult to make a clear and accurate comparison). There were no AMS results for VP1 due to a fault on the system and therefore the reported result of 0.4mg/m^3 should be viewed as a single spot sample rather than accurate average. SO_2 and NO_x emissions were reported as being very far below the permitted limits; however as there are no clear conclusions on BAT-AELs within the BREF, it is not possible to make a clear assessment of how this performance compares to BAT. The competent authority did, however, support the view that the operator had made a significant investment in progressive technological upgrades for several years as part of the IPPC improvement programme. **Blast furnace air heaters** Reported results for particulates, SO_2 and NO_x are all below permitted levels. The particulate values quoted (3.6 mg/m^3) are a calculated figure and therefore it is unclear how accurate this may be. However, the value is below the BAT-AEL. NO_x emissions are consistently below the BAT-AEL of 350 mg/m^3 (BREF conclusions 7.4). However, it should be noted that the BAT-AEL is given for an oxygen concentration of 3%, whereas the reported concentration is at 19% oxygen. **Coal transport belt and coal milling unit** The BAT-AEL of 1-15mg/m^3 for coal transport is reported as being achieved by the installation. Upgrades of the transport line have been made by the operator during the past few years. The particulates performance of the coal/coke milling unit is within the permitted levels but almost twice the BAT-AEL. No further BAT-AELs or conclusions are presented in the BREF document; however, all reported values are within permitted limits. Based on published data on ambient air quality, the following information was reported for the month of August 2008. CO: 0.3-1.3 µg/m^3 (limit 10 µg/m^3) SO_2 (24-hr): 15-20 µg/m^3 (limit: 125 µg/m^3) SO_2 (1-hr): 12-42 µg/m^3 (limit: 350 µg/m^3) NO_2 (1-hr): 27-99 µg/m^3 (limit: 220 µg/m^3) PM_{10} (24-hr): 12-52 µg/m^3 (limit: 50 µg/m^3) The results indicate a high degree of compliance with ambient air quality standards although a breach of the dust value was reported on 02 August 2008. No other breaches were reported. **Water emissions – BAT-AELs are not available upon which to asses performance.**
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The permit does not set a direct requirement to develop a site closure plan more than two months prior to announcement of closure. There is a central government fund to clean up industrial pollution however it is not clear how the Polluter Pays Principal comes into effect unless a review of a closure plan is undertaken. It has not been possible to obtain additional information due to lack of input from the operator.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the competent authority for ensuring compliance:** The competent authority reviews the results of operator's monitoring submissions and annual environmental reports. A review of all the permit conditions is required on 8 year cycles but in reality with any change to the installation, a review of the existing permit is completed and an amendment issued as a supplemental permit. Site inspections are also undertaken by the Environmental Inspectorate. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** The competent authority reported than no issues of compliance have yet required sanctions. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** It has not been possible to obtain this information due to lack of input from the operator. **Procedures used or action taken by the operator in the event of non-compliance** It has not been possible to obtain this information due to lack of input from the operator.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The competent authority does conduct on-site inspections at a frequency of a minimum of every 2 years, which is in line with requirements of national laws. The inspector interviewed noted that there must be adequate justification for them to undertake an inspection and an announcement must be made to the operator to arrange this. The consideration of inspection justification around a focused topic provides a more focused and relevant inspection.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** The results of monitoring were reported by the competent authority to be available upon request however the assessment team had significant difficulties in obtaining copies of this data.

Key observations from this case study assessment

- Similar to other case studies undertaken in Slovakia, the operator exercised their rights under national law to split the site and develop several applications for IPPC permits rather than a single integrated permit covering all key operations.
- The applications made by the operator contained all the key elements required by Article 6 although the early applications lack some specific technical detail and further technical requests were made by the competent authority.
- The permit has been developed on a generic template structure that ensures it contains all the key elements required by Article 3. The two permits assessed contained a more extensive volume of information regarding the monitoring measures and standards relative to other Slovak permits. The permit has been drafted by the competent authority having regard to the information contained within the BREF document on production of iron and steel and Slovakian national GBRs.
- ELVs for air emissions have been included in the blast furnace and sinter plant permits for all key emission points. The ELVs are set out in GBR 706/2002 Z.z. and competent authorities must set ELVs at least as strict as those given in this GBR. Stricter limits may be set if there is considered to be a need for them on the basis of decisions made in conjunction with other competent authorities responsible for air and water protection.
- No ELV has been set for dioxins/furans. A BAT-AEL of 0.5-1.5 ngTEQ/m^3 is indicated in the BREF on production of iron and steel.
- The permit does not contain provisions on the minimisation of transboundary pollution as the competent authority judged this unnecessary on the basis of an assessment of environmental air quality.
- Based on performance data submitted by the competent authority, the installation meets all of its permitted limits.
- Based on a comparison of the permit limit values against BAT-AELs (where conclusions have been reached and reported in the BREF on Iron and Steel Production), the performance of the installation is equivalent to BAT in most areas. With regard to particulates, reported emissions from the sinter plant are above the BAT-AEL but not by a significant margin; reported emissions from the blast furnaces are above the BAT-AEL by a factor of two; and reported emissions from the coal milling unit are also above the BAT-AEL by a factor of two. For the remaining emissions where a comparison with BAT-AELs has been possible, the performance of the installation is indicated to be within AEL ranges.
- The CO emissions from the blast furnace air heater show some significant variability (reported results), which may potentially indicate poor performance optimisation. No clear conclusions on CO performance are presented within the BREF and therefore further analysis has not been possible.
- There has been consideration of local factors such as local environmental conditions in the determination of suitable permit conditions, in particular the relevant transposition of ELVs from the GBR 706/2002 Z.z. The competent authority indicated that the impact of the installation operations on the surrounding environment did not warrant stricter ELVs than those in the GBR. Published data on ambient air quality in the surrounding area shows a single breach of the 24-hr average limit for dust (50 µg/m^3) within the period of 1 month. This is indicative of a potentially significant localised air quality impact that casts doubt upon whether the dust limits of 100 mg/m^3 are sufficient to fully ensure compliance with Directive 1999/30/EC.
- Extensive monitoring requirements are detailed within the permit conditions and based on the response of the competent authority the company current complies fully with these requirements. Confirmation of this has not been possible due to a lack of relevant information.
- The lack of cooperation provided by the operator made an objective performance assessment difficult in this case study. It has not been possible to draw any conclusions as to whether the installation fully complies with the conditions within the IPPC permits or fully meets the ELVs as set out within.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Sinter belts 1-4 (č.201 and č.202)	VOC	SP1 20 mg/m^3 SP2 20 mg/m^3 SP3 13 mg/m^3 SP4 13 mg/m^3	150 mg/m^3	<20 mg/m^3	Yes	Yes	101,325 kPa, 0°C, 19% O_2 Continuous monitoring results were available for CO, NOx, SO_2, and particulates. Averaging periods were not specified within the submitted monitoring data and no clear conclusion is provided in the ISP BREF.		
	Particulates	SP1 68.2 mg/m^3 SP2 54.2 mg/m^3 SP3 64 mg/m^3 SP4 55.7 mg/m^3	100 mg/m^3	<50 mg/m^3 [1]	Yes	No			
	CO	SP1 2992 mg/m^3 SP2 3174 mg/m^3 SP3 3379 mg/m^3 SP4 3357 mg/m^3	6000 mg/m^3	No BAT-AEL	Yes	N/A			
	NO_x	SP1 107 mg/m^3 SP2 109 mg/m^3 SP3 108 mg/m^3 SP4 104 mg/m^3	400 mg/m^3	No BAT-AEL	Yes	N/A			

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	SO_2	SP1 195 mg/m^3 SP2 189 mg/m^3 SP3 179 mg/m^3 SP4 196 mg/m^3	400 mg/m^3	<500 mg/m^3	Yes	Yes			
	Mercury	All <0.003 mg/m^3	0.1 mg/m^3	No BAT-AEL	Yes	N/A			
	Be+Cd	All <0.02 mg/m^3	0.1 mg/m^3	No BAT-AEL	Yes	N/A			
	Hg+Tl	All <0.03 mg/m^3	0.2 mg/m^3	No BAT-AEL	Yes	N/A			
	As+Cr_6+Co+Ni	All <0.14 mg/m^3	1 mg/m^3	No BAT-AEL	Yes	N/A			
	Se+Te	All <0.076 mg/m^3	1 mg/m^3	No BAT-AEL	Yes	N/A			
	Sb+Sn+Cr+Mn + Cu+Pb+V+Zn	All < 4.4 mg/m^3	5 mg/m^3	No BAT-AEL	Yes	N/A			
Blast Furnaces VP1-VP3 (č.231, č.232 and č.233)	Particulates	VP1 0.4 mg/m^3 VP2 27.6 mg/m^3 VP3 36.2 mg/m^3	100 mg/m^3	<10 mg/m^3	Yes	Mixed	101,325 kPa, 0°C, 19% O_2 Continuous monitoring results were available for particulates only. Averaging periods were not specified within the submitted monitoring		

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	SO_2	VP1 9 mg/m^3 VP2 28 mg/m^3 VP3 35 mg/m^3	500 mg/m^3	No BAT-AEL	Yes	N/A	data.		
	NO_x	VP1 1 mg/m^3 VP2 1.7 mg/m^3 VP3 1.5 mg/m^3	500 mg/m^3	No BAT-AEL	Yes	N/A			
	Be+Cd (VP1 only)	LOD (0 mg/m^3)	0.1 mg/m^3	No BAT-AEL	Yes	N/A			
	Hg+Tl (VP1 only)	LOD (0 mg/m^3)	0.2 mg/m^3	No BAT-AEL	Yes	N/A			
	As+Cr_6+Co+Ni	VP1 No Data VP2 0.03 mg/m^3 VP3 0.04 mg/m^3	1 mg/m^3	No BAT-AEL	Yes	N/A			
	Se (VP1 only)	LOD (0 mg/m^3)	1 mg/m^3	No BAT-AEL	Yes	N/A			
	Sb+Sn+Cr+Mn + Cu+Pb+V+Zn	VP1 0.3 mg/m^3 VP2 0.85 mg/m^3 VP1 1.4 mg/m^3	5 mg/m^3	No BAT-AEL	Yes	N/A			
Blast Furnace Air Heaters VP1-VP3 (č.206, č.208	Particulates Notes 1 and 2	VP1 3.6 mg/m^3 VP2 3.6 mg/m^3 VP3 3.6 mg/m^3	100 mg/m^3	<10 mg/m^3	Yes	Yes	No further information provided.		

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
and č.210)	SO_2	VP1 63 mg/m^3 VP2 160 mg/m^3 VP3 77 mg/m^3	500 mg/m^3	No BAT-AEL	Yes	N/A			
	NO_x	VP1 11 mg/m^3 VP2 50 mg/m^3 VP3 31 mg/m^3	500 mg/m^3	<350 mg/m^3	Yes	Yes			
	CO	VP1 3336 mg/m^3 VP2 252 mg/m^3 VP3 5097mg/m^3	6000 mg/m^3	No BAT-AEL	Yes	N/A			
	TOC	VP1 36 mg/m^3 VP2 1 mg/m^3 VP3 36 mg/m^3	150 mg/m^3	No BAT-AEL	Yes	N/A			
Coal transport belt č.267	Particulates	10 mg/m^3	50 mg/m^3	<1-15 mg/m^3	Yes	Yes	No further information provided		
Coal/coke milling unit č.264	Particulates	32.5 mg/m^3	100 mg/m^3	<1-15 mg/m^3	Yes	No			
	SO_2	195 mg/m^3	500 mg/m^3	No BAT-AEL	Yes	N/A			
	NO_x	38 mg/m^3	500 mg/m^3	No BAT-AEL	Yes	N/A			
	CO	2320 mg/m^3	6000 mg/m^3	No BAT-AEL	Yes	N/A			
	TOC	97 mg/m^3	150 mg/m^3	No BAT-AEL	Yes	N/A			

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Notes: Note 1: The results from the VP1 blast furnace air heater could not be monitored/measured and have been calculated. No further explanation of this was given by the competent authority. Note 2: On the results for particulate matter, only emissions from the VP2 and VP3 blast furnace air heater could not be monitored/measured and have been calculated instead.									
Emissions to water									
Wastewater plant	pH	7.8	6-9	N/A	Yes	Unknown	Continuous STN 83 0540-6:1982	24 hour composite 15 min intervals	N/A
	Phenol Cyanide N-NH4	0.02 mg/l 0.01 mg/l 0.1 mg/l	0.05 mg/l 0.1 mg/l 2.0 mg/l	N/A	Yes	Unknown	Phenol: STN ISO 6439:1996 Cyanide: STN ISO 6703-1: 1998 NH_4: STN ISO 7150-1:1995	24 hour composite 30 min intervals	N/A
	COD SS Dissolved Solid	16 mg/l 14 mg/l 484 mg/l	30 mg/l 35 mg/l 740 mg/l	N/A	Yes	Unknown	COD: STN ISO 6060: 2000 NL: STN EN 872: 1999 NEL: STN 83 0540-4:1982	24 hour composite 30 min intervals	N/A
Notes:									
Emissions to land									
No emissions directly to land are authorised within this permit.									

3.4.7 Case study 4 – Spain

Assessment of permit determination procedures and permit conditions

Introduction

The unique reference number for this installation is 02/ES/31.

The information in this table is based on the detailed assessment for this installation in Appendix C4. Further information and elaboration on certain points is included in the detailed assessment.

Overview description of type of installation/application

The permit covers the activities of two installations. For the purposes of this assessment they will be referred to as Installation A and Installation B.

The installations produce Iron and Steel products and cover the following activities under Annex 1 of the IPPC Directive:

- Section 2.2 - Installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting, with a capacity exceeding 2,5 tonnes per hour.
- Section 1.3 - Coke Ovens.
- Section 2.3 - Installations for the processing of ferrous metals: hot-rolling mills with a capacity exceeding 20 tonnes of crude steel per hour application of protective fused metal coats with an input exceeding 2 tonnes of crude steel per hour.
- Section 2.6 - Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process where the volume of the treatment vats exceeds 30 m^3.
- Section 5.4 - Landfills receiving more than 10 tonnes per day or with a total capacity exceeding 25 000 tonnes, excluding landfills of inert waste.

This assessment is based on a review of relevant documentation and a site visit (meeting) with the Operator. The Competent Authority was not available for the meeting.

This assessment focuses on the integrated blast furnaces and sinter plants at Installation A (details of processes at Installation B have been included in this section for information/context). Historically there was a sinter plant and blast furnace at Installation B; however this was retired and these processes moved to Installation A which is close to a major port.

Annex 1 Section 1.2 of the permit provides considerable detail on the processes, products and sub-products; raw materials used; and the energy and resources consumption for the installations. Both installations operate a wide range of integrated processes including:

<u>Installation A</u>

- 1 Coke Oven (production capacity – 1.05 Mt/year)
- 2 Blast Furnaces (A & B) (production capacity – 4.7 Mt/year)
- 1 Steel Mill (production capacity – 1.1 Mt/ year)
- 2 Sinter Plant (A & B) (production capacity – 6.05 Mt/ year)
- Heavy plate mill (production capacity – 0.62 Mt/ year)
- Wire rod mill (production capacity – 0.68 Mt/ year)
- Rail mill
- Coal yard
- Ore Yard
- Wastewater Treatment

<u>Installation B</u>

- 2 Coke ovens (production capacity –1.44 Mt/ year)
- Steel Mill (production capacity – 4.2 Mt/ year)
- Stripping lines (production capacity – 2.05 Mt/ year)
- Pickling lines

	▪ Hot lamination ((production capacity – 3.6 Mt/ year) ▪ Tandem lines (production capacity – 1.9 Mt/ year) ▪ Temper lines (production capacity – 1.05 Mt/ year) ▪ 2 Galvanising lines (production capacity – 0.8 Mt/ year) ▪ Organic coating line (production capacity – 0.25 Mt/ year) ▪ Thin plate Lines (production capacity – 0.3 Mt/ year) The main products that are produced include laminated products such as hot reels or coils, cold metal sheets, tin plate, galvanised, painted metal sheets, outlines/profiles, lanes, tracks, rounds. Annual production is approximately 4 million tonnes cast iron and 4.2 million tonnes steel per year. Cast iron is transported to Installation B by rail (owned by the company). This is then transported to Installation A for processing in the blast furnace. Coke and anthracite fuels are used in the sinter plant, with natural gas for other furnaces.
Type of permit/issue date	The Operator submitted the application for an IPPC permit to operate these *existing installations* under transitional arrangements. One permit covers both installations as well as hazardous and non-hazardous waste disposal sites. The application was submitted on 7th October 2005. The permit was issued on 2nd May 2008.
Basis of BAT determination	The Operator's IPPC application contained a detailed assessment of actual operational parameters and equipment against BAT and this, according to the Operator, was used as a key source in the determination of suitable permit conditions (Note: the Competent Authority was not available for interview during this assessment, therefore this could not be confirmed). From the review of the BAT assessment submitted by the Operator, it is clear that all the main processes, including the sinter plant and blast furnaces were covered. For each process described, the relevant BREF document is clearly referenced. Details of this assessment are provided in Annex I Section I.1 of the permit, along with a list of all the documentation submitted with the application. Annex III of the permit lists each BREF and the main legislation used to assess BAT and set permit conditions for the installation. The BREF on Production of Iron and Steel (December 2001) was the main document used. Other BREFs used to assess BAT include Ferrous Metals Processing Industry (Dec. 2001) and Non Ferrous Metals Industry (Dec. 2001).
Permit application	
Requirements of Article 6	An assessment of the documentation submitted by the Operator with the application showed that all the key elements required by Article 6 were addressed. A considerable amount of additional information was requested by the Competent Authority between 2005 and 2007. The Competent Authority did not participate in this assessment and therefore could not comment on the quality of the application.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The assessment of this installation has shown that conditions are included within the permit that govern the basic obligations of the Operator according to Article 3. The permit sets out general and technical conditions to which the Operator must adhere, designed to ensure that the impact of activities on the environment are minimised as far as practicable. These conditions offer protection to air, water, land and groundwater from the activities of the installation.

Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air** Annex III, Section III.3 sets out the ELVs for emissions to air for the installation. ELVs have been included in the permit for the blast furnace and sinter plant for all key emission points. ELVs have been based on Decree 833/75 and associated Ministerial Orders that may be considered as General Binding Rules (GBRs), as well as BAT-AELs. It should be noted that emission limits for heavy metals have not been included for the sinter plant; these have been identified in the BREF for Iron and Steel as significant pollutants from the sinter strand. It would be expected that emission limits should be imposed for these pollutants by the Competent Authority. **Water** The permit covers all discharges to public sewer and sea. The installation discharges to both a salmonid river and an estuary with separate authorities regulating the different discharges. Annex IV Section IV.1 of the permit sets out the ELVs for emissions from Installations A and B. The permit identifies 16 point sources from Installation A that are required to be monitored for specified parameters by dates set out in the permit. The Operator is required to monitor emissions from the overflow from the sinter plants (points 6 & 7) and wastewater from in two point sources in the blast furnace facility (points 12 & 13) at Installation A (See Table A.1b below for details of parameters measured) It has been noted that there are no requirements to monitor heavy metals from the blast furnace discharge points. The BREF for Iron and Steel Production states that wastewaters from the blast furnaces from rinsing or from the wet waste gas treatment system should be treated by heavy metal precipitation, neutralisation and sand filtration. Details of the treatment techniques that must be in place for each type of wastewater have been given and the dates for the implementation of these conditions are specified. From the 31/12/12 continuous monitoring must be in place to measure key parameters including; flow, pH, temperature, ammonia, TOC, turbulence and conductivity from specified discharge points. **Land** ELVs are not provided for emissions to land as these are not permitted by the permit. **Protection of soil and groundwater** Annex V Section 9 includes conditions for the protection of soils and groundwater. No uncontrolled emissions are permitted. The Operator is required to monitor soil and groundwater, and any accidental spills of wastes will be reported to the Water Directorate and a detailed report on the causes, monitoring and measures taken will be provided. The Operator is required to apply BAT for the protection of soil and groundwater from pollution. **Waste** No ELVs have been set for waste although several conditions relate to the relevant GBRs (833/88 and 10/98) on the correct management of wastes and conditions in the permit require the Operator to minimise wastes and recover them where practicable. Estimates of the waste produced (kg/yr) from the sinter plants and blast furnaces have been included along with their respective waste codes. **Transboundary considerations** There is no mention in the permit of transboundary pollution.

Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** **<u>Sinter Plant</u>** The key environmental aspects of sinter plant operations are emissions of dust, heavy metals, NO_x, SO_2 and dioxins. It is clear from the permit that ELVs have been set for the main pollutants based on the Royal Decree 833/75 (on Protection of the Atmosphere) or on BAT-AELs; and where these have been used to set an emission limit this is clearly referenced within the permit. As stated previously, limits have not been included for heavy metals, which are key environmental pollutants from the sinter strand. Based on a comparison of the permit emission limit values against BAT-AELs (where relevant BAT-AELs could be identified) all permit ELVs, with the exception of the particulate limits for F6 & F7 and the SO_2 limit for F2 & F3 in the sinter plant, are within the BAT-AEL ranges. It was not possible to draw conclusions as to why the aforementioned limits were set outside BAT-AELs ranges as the Competent Authority was not available for interview. **<u>Blast Furnace Plant</u>** The key environmental emissions associated with the blast furnace are emissions of dust, treatment of fumes and managing slag by-product. ELVs for particulates are above the BAT-AEL ranges. The ELV for SO_2 from F17 is significantly higher than the BAT-AEL (4,300 mg/m^3 compared with 500 mg/m^3). The permit contains conditions that relate to the recovery and management of wastes in accordance with BAT. **<u>Conclusion</u>** It is evident from review of the permit and application that BAT was considered when setting permit ELVs. Conditions for the operation of the installations are clearly based on BAT for the sector (as described under Question 2 of the detailed assessment in Appendix C4). The Operator has made an appeal to the Competent Authority as they do not agree with some of the ELVs that have been set, specifically with regards to the ELVs for particulate emissions from Sinter Plant B. The electrostatic precipitators currently in place cannot achieve the limits in the permit. The Operator commented that it was impossible to continuously meet the 50mg/m^3 limit, and that more time is needed to implement measures to reduce particulates emissions; they have requested that the Competent Authority allow them two years to meet these conditions. This appeal was under consideration at the time of the assessment. A Pollution Reduction Plan is currently being implemented at the installation to meet the permit conditions. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** ELVs within the permit have been based on national legislation. It has been indicated by the Operator that the Competent Authority would set stricter ELVs if there was a requirement to do so but that there were no requirements for stricter limits to be set for emissions to air. There are legal requirements for the water and local air quality authorities to ensure that the installations comply with limits as set out in the relevant legislation in order to ensure no breach of national or regional air and water quality standards. This would require that local environmental conditions are considered for the installation. There are six air quality monitoring stations in the area of the installations and the Operator must comply with ambient air quality limits. PM_{10}, NO_x, SO_2, benzene, H_2S and Pb are measured along with the meteorological conditions. Monitoring data is to be submitted to the Air Quality Directorate for the region. It is understood that certain wastewater discharges are to salmonid rivers and stricter limits have been set in the permit by the relevant Water Quality Authority (Hydrographic Confederation) for these discharges and are regulated directly by this authority. An ecological assessment was undertaken on the river water quality and the results of this were used in determining permit limits for these discharges. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** No evidence of such factors influencing permit conditions was identified.

Use of relevant BREF documents in setting permit conditions?	The BREFs that were used to set permit conditions are clearly referenced in Annex III of the permit along with the relevant GBRs. The BREF on Production of Iron and Steel (December 2001) was the main document used. Other BREFs used to assess BAT includes Ferrous Metals Processing Industry (Dec. 2001) and Non Ferrous Metals Industry (Dec. 2001). There is no-reference to country-specific guidance.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Annex III Section III.3 provides a list of tables that set out the ELVs for emissions to air from all processes and these are separated into Installations A and B. Monitoring frequencies are provided for each parameter. Continuous emissions monitoring (CEM) is required to be in place for particulates from the sinters and blast furnaces and these CEMSs must comply with the standard UNE-EN 14181. The actual methods and averaging periods for monitoring of emissions have not been specified and there are no references to the relevant standards that apply. These may be set out by the external organisation that undertakes periodic monitoring of emissions from the installation, but this has not been clearly specified in the permit. Averaging periods have been provided separately by the Operator. The averaging periods are those required by the national Decree for Industrial Air Pollution Prevention and Correction (1976). The permit specifies a requirement to supply monitoring data to the competent authority. When reporting monitoring data to the Competent Authority, the Operator is also required to provide information on the operating conditions of the installation, the equipment used in the measurements, as well as the date of its calibration and the methodology for the taking of samples and analysis. Monitoring methods and reference measurements for discharges to water are set out in Supplement 2 of Royal Decree 995/2000 and the Order MAM/3207/2006 (MMA-EECC-1/06) for the analysis of discharges to water. The permit provides details of frequency of monitoring and averaging periods for all emissions parameters to be measured. Emissions monitoring will be carried out in accordance with Article 255 of Real Decree 606/2003) and a certification given by an external monitoring organisation if the requirements of the permit are being met. **Are the monitoring requirements sufficiently detailed?** No, as indicated above, methodologies and averaging periods have not been provided in the permit for emissions to air and no information on the applicable standards has been included . Monitoring requirements for water emissions are considered to be sufficiently detailed. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** The only clear indication that the BREFs were used to set monitoring conditions for emissions to air is with regards to the requirement for continuous monitoring of particulates. Monitoring systems must be calibrated and verified according to the standards UNE-EN 14181 and UNE-EN 17025. **Does the permit include information on duration in relation to monitoring requirements?** Yes, emissions to air that are not monitored continuously will be monitored either every 3 months, quarterly or annually. The duration of monitoring with regards to water emission is also provided.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	The permit contains a condition relating to the provision of information to the Competent Authority in the event of abnormal or emergency situations and requires that all necessary measures should be taken to prevent pollution in these situations.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** GBRs (Decree 833/75) have been used to set ELVs for emission to air. Other GBRs that must be complied with include those for waste management and water discharges (as referred to above). These GBRs have been referenced within the permit, clearly indicating which ELVs for each pollutant source have been based on specific GBRs,

Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** Regional and local environmental conditions are assessed using ambient monitoring stations and local water monitoring networks. The Operator commented that the water quality limits for salmonid rivers that must be complied with are stricter that those achievable by using BAT, and that this requires a upgrade to the wastewater treatment plants in order to meet these limits. Details on the specific techniques required that are stricter than BAT have been provided in Annex IV Section IV.1.1 of the permit which includes coagulation, flocculation and sedimentation.
Inclusion of information on period of validity of permit and when it will be reconsidered/updated (Article 13)	The permit is valid for a maximum of 8 years. If the Operator wants to renew the permit, this must be requested 10 months before it expires. Any modifications must be communicated to the Competent Authority and a summary must be provided describing the modification (substantial or not substantial). If the change is substantial, then the permit will be reviewed. The Operator is currently appealing some of the conditions in the permit relating to ELVs for particulate emissions and wastewater discharges. Depending on the outcome of this appeal, the permit may need to be reviewed.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The permit is available on the Competent Authority's website. The Operator indicated that the permit application may be available upon request, but this could not be confirmed with the Competent Authority. **Are monitoring records made available to the public?** No, this information is not published. It is not clear if this information is available upon request, the Operator did not confirm this and the Competent Authority was not available for interview.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	Based on monitoring data provided by the Operator for October 2008, it has been concluded that current emission monitoring performed by the operator includes: ▪ Monitoring of all key pollutants for emission to air including SO_2, NO_x, CO, PCDD/PCDF and particulates; the exception is heavy metals where no monitoring requirements have been included. ▪ Continuous monitoring for particulate emission points in the sinter plant. ▪ Periodic monitoring of all other key pollutants. ▪ Measurements of subsoil and groundwater. ▪ Monitoring of wastewater discharges to salmonid rivers, estuary and sewer. Continuous monitoring for some discharge points (these were not specified). The permit requires that all wastewater discharge points have continuous monitoring. ▪ Monitoring of ambient air quality for SO_2, NO_x, PM_{10}, Pb, benzene and H_2S, in order to meet local air quality limits. ▪ The averaging periods/frequency applied by the Operator (60 minute averages), as specified in the monitoring results table below, are understood to be the same as the averaging periods required under the permit (although they were provided separately by the Operator as they could not be identified in the permit).

Operator's compliance with monitoring conditions	There is no treatment in place for runoff from storage areas to rivers; the Operator indicated that this is currently being implemented. Continuous emissions monitoring has not been carried out on all discharge points to water for TOC, flow and conductivity, as required by the permit. Continuous monitoring is not in place for rainfall water, as required by the permit. Detailed information on what monitoring was undertaken with regards to water discharges was not obtained. The Operator commented that there are a number of areas where water discharge monitoring does not comply with the permit requirements. It is not clear if the averaging periods applied by the Operator for emissions to air meet the requirements of the permit (as these are not specified within the actual permit) or whether the Operator is applying different averaging periods.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	This data was not made available for this assessment.
Current emissions of key pollutants	This information is provided within the table below.
Assessment of Installation performance against BAT	Air emissions monitoring data for October 2008 was reviewed and assessed against permit ELVs and BAT-AELS (where applicable) to determine installation performance. Data was not made available for all point sources. The main conclusions drawn from a comparison of the monitoring report and the ELVs set out in the permit are discussed below: NO_2 and particulate emissions from Sinter B F4 and particulate emissions from Sinter A F3 all exceeded permit ELVs. Data for SO_2, NO_x and particulate concentrations from all other sampled units are thought to be within the limits set in the permit. Where BAT-AELs exist for emission sources, some have been exceeded. SO_2 and particulate emissions from Sinter B F4, and particulates from Sinter A F3 are above the BAT-AEL ranges. It is evident, from discussions with the Operator, that the main area of concern is particulate emissions from the sinter plants. The Operator confirmed that emissions are frequently above the permit limits for particulates. They have inadequate ESPs in place for abatement which cannot achieve the limits set within the permit. The ELV was previously 150 mg/m^3; however BAT according to the BREF is <50mg/m^3 as an achievable level in normal operation with ESP, and this was used to set this limit in the permit. The Operator expressed a concern that investment in an immediate upgrade of abatement equipment to meet BAT cannot at present be made, and according to the Operator this can only be done within a realistic time period of 2 years. They are currently appealing the decision to impose the above permit ELV with the Competent Authorities. Based on discussions with the Operator, the area of poorest performance is the wastewater emissions to river. The Operator confirmed that emissions are frequently above the specified permit ELVs. The rivers were only recently classified as salmonid (the result of which is that much stricter limits apply). The water discharge limits in the permit are based on water quality standards for salmonid rivers, which are much applying stricter limits. The Operator commented that they cannot consistently meet limits for suspended solids from the coal storage areas. It should be noted that the Operator reports that they have made considerable efforts in order to try to meet the discharge limits. They have invested in new wastewater treatment plants since 2000. In total 27 treatment plants have been constructed which include physicochemical and biological treatment, activated sludge treatment with aeration and recirculation, sand and activated carbon filters, homogenization, neutralization, coagulation, flocculation, settling, oxidation, oil extraction systems, break of oil emulsions, flotation, clarification. The application of these treatment techniques has not, however, been sufficient to meet the water discharge limits established in the permit according to the Operator. As a result, the water emissions are now frequently above the permit limits and they have been issued with a number of fines from the water regulating authority for these breaches. The Operator's argument is that there are plans to install an industrial collector which will essentially collect wastewater from a number of industrial sources in the area, to be discharged to sea. It was agreed with the local administration that the different wastewater discharges would be connected to the

	future industrial collectors; however the construction of the collector has been considerably delayed (now expected in late 2009) and the Competent Authority was required to set limits based on the water quality standards of the salmon rivers, which are much stricter than the limits set in the previous permit. Monitoring data for water was not made available for discharge points from the blast furnaces or sinter plants; therefore performance of these areas could not be determined. The Operator commented that noise levels have frequently been above specified limits (limits not in the permit but set out in relevant GBRs). Measures have been taken to address this issue; however they indicate that the close proximity to a motorway and other industrial sources contributes to the overall noise pollution.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	Measures are in place for closure of the landfill sites to control leachate and undertake monitoring. However, the Operator did not indicate having measures in place for closure of the installations and conditions for this could not be located within the permit. Each landfill site has a treatment facility for leachate and the Operator is required to monitor the sites for 50 years after closure.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The Competent Authority reviews the results of operator's monitoring submissions and annual environmental reports. The Operator must show compliance with permit conditions and report on this annually. Site inspections are also undertaken regularly by the Competent Authority. This would normally involve inspection of all processes, spot sampling, discussing investments in environmental improvements, inspecting monitoring equipment and records. The Competent Authority agrees an action plan with the Operator to meet permit conditions and actions for continued improvement. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** There have been no sanctions from the Competent Authority responsible for emissions to air. The Competent Authority has been made aware of the breaches in permit ELVs for emissions to air but has not, according to the Operator, applied any sanctions. The Hydrographic Confederation which regulates discharges to river has imposed a number of fines on the Operator for breaching permit limits. The Operator cannot meet current limits and breaches continue to occur. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** Daily operational checks are undertaken on key elements, including process control, monitoring and compliance with IPPC. Continuous monitoring is in place for key pollutants as indicated above (and in Appendix C4. Calibration and verification of monitoring systems must be carried out annually in accordance with the relevant standards. **Procedures used or action taken by the operator in the event of non-compliance** The IPPC permit contains specific procedures and conditions that must be followed in the event of non-compliance. If there is any fault or stoppage in operations this is investigated and there are internal procedures for responding to these situations. If there is an incident that could potentially cause pollution, then this is communicated to the Competent Authority and report on the incident is submitted. Preventative actions and decrease of production capacity will be implemented where necessary.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The Operator could not provide this information. The Competent Authority did not participate in this assessment.

Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** No, this information is not published. It is not clear if this information is available upon request; the Operator did not confirm this and the Competent Authority was not available for interview.

Key observations from this case study assessment

- The IPPC permit covers two separate installations and four waste disposal sites. This assessment concentrated mainly on Installation A which operates the sinter plants and blast furnaces (the focus of this study for this sector).
- The application made by the Operator contained all the key elements required by Article 6, although a substantive amount of further information was requested in order for the Competent Authority to be able to determine the permit. The Competent Authority has not been interviewed and so has not commented on the quality of the application.
- This assessment demonstrates the permit mainly covers the requirements of Article 3 (a)-(f); however the permit did not contain conditions to address site closure. The Operator does not have a site closure plan in place for closure of the installations, only for the landfill sites.
- ELVs for air emissions have been included for the blast furnace and sinter plants for all key emission points. ELVs for emissions to air have been based on Royal Decree 833/75 and the BREF documents, mainly the 'Iron and Steel' BREF.
- ELVs have not been included for heavy metals from the sinter plants.
- It is evident from review of the permit that BAT was considered when setting permit ELVs. Conditions for the operation of the installations are clearly based on BAT for the sector (the techniques are described in Appendix C4). The majority of permit ELVs have been set within BAT-AEL ranges.
- However, for the sinter plant, based on a comparison of the permit emission limit values against BAT-AELs (where relevant BAT-AELs could be identified) all permit ELVs, with the exception of the particulate limits for F6 & F7 and the SO2 limit for F2 & F3 in the sinter plant, are within the BAT-AEL ranges. For the blast furnaces, ELVs for particulates are above the BAT-AEL ranges (40-120 mg/m^3 compared to a BAT-AEL of <10 mg/m^3). The ELV for SO_2 from F17 is significantly higher than the BAT-AEL (4,300 mg/m^3 compared with 500 mg/m^3). It was not possible to draw conclusions as to why the aforementioned limits were set outside BAT-AELs ranges as the Competent Authority was not available for interview.
- The Operator has made an appeal against some of the conditions within the permit, mainly those relating to the ELV for particulate emissions from the sinter plant and wastewater discharges to river (the operator is frequently unable to meet these ELVs). The Competent Authority was considering this appeal at the time of the site meeting.
- Local air quality monitoring for the key pollutants is undertaken at six monitoring stations, as part of the local air quality monitoring network of which the Operator is a part of, and monitoring data is sent in real time to the Competent Authority.
- Monitoring requirements for emissions to air are not sufficiently detailed within the permit. In particular, information on methods for monitoring and averaging periods has not been included. Averaging periods given in this report have been provided separately by the Operator. These are based on the requirements of the national Decree for Industrial Air Pollution Prevention and Correction (1976). Water monitoring information is much more detailed and is considered sufficient.
- It is planned that wastewater emissions will be collected by an industrial collector and discharged to sea. This will be regulated by the water authority and the Operator has made requests to discharge to this system when it is operational (late 2009).
- Monitoring data shows that the installation is not complying with permit ELVs for particulate emissions from the sinter plant. The ESP abatement equipment used at the installation is not currently adequate to achieve the permit limits.
- The Operator indicated that there have been a number of breaches of the water emission limits, specifically for suspended solids from the coal storage areas for which they have received fines from the regulating authority (Hydrographic Confederation). Discharges are to salmonid rivers which apply stricter limits than those achievable through the use of BAT. However, monitoring data was not made available for emissions from these sources; therefore performance could not be compared with permit ELVs (there is a permit-ELV of 25 mg/l for suspended solids).

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
<u>Sinters</u>									
Sinter A F2 (date of sample 31/10/2008)	Particulates	31 mg/m^3 (F2 only)	50 mg/m^3	<50 mg/m^3 (Note 1)	Yes	Yes	Continuous	60 mins (see notes)	3% O_2 content
	SO_2	391 mg/m^3 (F2 only)	1000 mg/m^3	<500 mg/m^3 [Note 2]	Yes	Yes	Monthly		
	NO_x	285 mg/m^3 (F2 only)	310 mg/m^3	No BAT-AEL	Yes	N/A	Monthly		
	PCDD/PCDF	No data	0.5 ng/m^3	<0.4 ng/m^3 (Note 3)	Unknown	Unknown	Annual		
Sinter B F4 (date of sample 01/10/2008)	Particulates	52 mg/m^3	50 mg/m^3	<50 mg/m^3 (Note 1)	No	No	Continuous	60 mins	
	SO_2	619 mg/m^3	1000 mg/m^3	<500 mg/m^3 [Note 2]	Yes	No	Monthly		
	NO_x	361 mg/m^3	310 mg/m^3	No BAT-AEL	No	N/A	Monthly		
	PCDD/PCDF	No data	0.5 ng/m^3	<0.4 ng/m^3 (Note 3)	Unknown	Unknown	Annual		
Sinter A F3 (date of sample 14/10/2008)	Particulates	83 mg/m^3	50 mg/ m^3	<50 mg/m^3 (Note 1)	No	No	Continuous	72 mins	3% O_2 content

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Sinter B F5 (date of sample 01/10/2008)	Particulates	48 mg/m^3	50 mg/m^3	<50 mg/m^3 (Note 1)	Yes	Yes	Continuous	60 mins	3% O_2 content
F6 and F7 (date of sample 15/10/2008)	Particulates	1 mg/m^3	150 mg/m^3	<50 mg/m^3 (Note 1)	Yes	Yes	Quarterly	26 mins	3% O_2 content
<u>Blast furnaces</u>									
F 10 (date of sample 08/10/2008)	Particulates	2 mg/m^3	100 mg/m^3	<10 mg/m^3	Yes	Yes	Quarterly	72 mins	3% O_2 content
F13 (date of sample 09/10/2008)	Particulates	5 mg/m^3	100 mg/m^3	<10 mg/m^3	Yes	Yes			
F18	Particulates	No data	100 mg/m^3	<10 mg/m^3	Unknown	Unknown			
F11 (date of monitoring 08/10/2008)	Particulates	1 mg/m^3	40 mg/m^3	<10 mg/m^3	Yes	Yes	Quarterly	72 mins	
F14 (date of sample 09/10/2008)	Particulates	<1 mg/m^3	40 mg/m^3	<10 mg/m^3	Yes	Yes		72 mins	
F16	Particulates	No data	40 mg/m^3	<10 mg/m^3	Unknown	Unknown		N/A	
F12 and F15	SO_2	No data	400 mg/m^3	500 mg/m^3	Unknown	Unknown	Quarterly	N/A	

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	NO_x	No data	400 mg/m^3	500 mg/m^3	Unknown	Unknown			
	CO	No data	2500	No BAT-AEL	Unknown	Unknown			
	Opacity	No data	20%	No BAT-AEL	Unknown	Unknown			
F17 (date of sample 02/10/2008)	Particulates	7 mg/ m^3	120 mg/m^3	<10 mg/m^3	Yes	Yes	Continuous	61 mins	
	CO	113 ppm	500 ppm	No BAT-AEL	Yes	N/A	Quarterly		
	SO_2	<14 mg/ m^3	4300 mg/m^3	500 mg/m^3	Yes	Yes			
	NO_x	<5 ppm	300 ppm	500 mg/m^3	Yes	Yes			

Notes:

Emissions from other point sources are included in the more detailed assessment in Appendix C4. The above focuses on the blast furnace and sinter plant.

Monitoring data are from October 2008.

The averaging periods above are the actual averaging periods applied by the Operator for this monitoring dataset: F7 26 mins; F25, F2, F4, F5 - 60 mins; F17 61 mins; all other points 72 mins. The averaging periods in the permit are all 60 minutes. They are understood to be the same as the averaging periods required in the permit (although they were provided separately by the operator as they could not be identified in the permit). Note that no averaging periods are specified for the BAT-AELs in the ISP BREF.

1) Achievable through the use of a range of techniques including de-dusting, ESP and fabric filtration (FF). For applications using FF, concentrations in the range 10-20 mg/m3 are achievable.

2) Achievable through lowering of sulphur input through lower sulphur content materials such as iron ore and coke breeze and minimisation of coke breeze usage. Wet gas desulphurisation (indicatively required only where breaches of EQS are likely) achieves levels of >100 mg/m3.

3) Achievable through use of use of fine wet scrubbing systems. Fabric filtration with addition of lignite coke powder also achieves low PCDD/F emissions (>98% reduction, 0.1 – 0.5 ng/m3).

4) Achievable with ESP. Emission concentration of 5-15 mg/m3 are achievable with bag filters.

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to water									
Monitoring data for discharge points from the Blast Furnaces and Sinter Plants was not available. As the focus of this assessment is discharges from the Blast Furnace and Sinter Plants, discharges to water from other process areas have not been assessed within this study.									
Emissions to land									
No ELVs have been set.									

3.4.8 Iron and steel production (sinter plants and associated blast furnaces) – summary

Based on the four installations reviewed for this sector (in Italy, the Netherlands, Slovakia and Spain), the following overall conclusions can be drawn:

- All four installations have permits that include ELVs for emissions to air and water. In three of these cases, the ELVs for the main air pollutants are set using General Binding Rules rather than on a site-specific basis. In three of the four cases, ELVs for key air pollutants are set above BAT-AELs. It was clear that ELVs set for the case study in the Netherlands were stricter overall than the other three case studies although there is a significant disparity between case study permits with regard to the ELVs set for specific pollutants.

- All case study respondents within the competent authority noted that, during determination, local factors were taken into consideration in setting of permit conditions and ELVs. Despite this, GBRs remain the prime mechanism by which permit ELVs have been set by competent authorities and therefore it was not clear in all cases how competent authorities are taking into account such factors according to Article 9(4) of the Directive.

- Dust is a primary concern within the iron and steel industry, a fact supported by this study, which demonstrates – in two of the four case studies – reported data for dust emissions from the sinter and/or blast furnace plants in exceedance of the ELVs as set in the permit.

- For the three of the four installations, there is evidence to suggest that not all emissions are within the BAT-AEL ranges (for the fourth installation, emissions were within the BAT-AEL ranges but available data was limited). In several instances, reported emissions are above the BAT-AELs.

- There was, in general, a lack of information on the averaging periods applicable to the permit ELVs and those that had been applied in the monitoring data provided, making a robust comparison problematic.

- All four case studies demonstrated clear evidence that members of the public were given the opportunity to comment upon and engage in dialogue regarding the determination and issue of the IPPC permits. Two of the case studies concerned installations where considerable local support against the plant was evident.

- For all four installations, monitoring data was collected and reported to the competent authority. For three of the installations, the monitoring undertaken complied with the permit conditions with the picture mixed for the remaining one.

- Inspections of the installations were reported to be undertaken at three of the four installations, with four or more annual visits reported for one installation (Netherlands) but fewer than one visit for two installations (the Slovakian and Italian installations). No information was available on inspections for the Italian installation.

The table below provides an indicative summary of the standards and emissions to air of key pollutants from this sector. In particular, it includes information on the relevant BREF BAT-AELs; ELVs set in permit conditions; and actual installation performance. This information is only intended to be indicative of the broad ranges of these values and the reader is referred to the assessments for each installation for further information on the emissions from specific sources and the applicable permit ELVs and BAT-AELs.

Table 3.10 Indicative information on emissions of certain air pollutants from iron and steel installations (BAT-AELs, permit ELVs and actual installation performance)

Member State	Pollutant	BAT-AEL (Note 1)	Permit ELVs (Note 1)	Actual emissions (Note 1)
Sinter plant				
Italy	Dust	<50 mg/m^3 (10-20 mg/m^3 with fabric filter)	50 mg/m^3	1-18 mg/m^3
Netherlands	Dust	<50 mg/m^3 (10-20 mg/m^3 with fabric filter)	40-250 mg/m^3	289 mg/m^3
Slovakia	Dust	<50 mg/m^3 (10-20 mg/m^3 with fabric filter)	100 mg/m^3	54-68 mg/m^3
Spain	Dust	<50 mg/m^3 (10-20 mg/m^3 with fabric filter)	50 mg/m^3	31-83 mg/m^3
Italy	SO_2	<500 mg/m3 (<100 mg/m^3 with wet FGD)	None	No data
Netherlands	SO_2	<500 mg/m3 (<100 mg/m^3 with wet FGD)	40 mg/m^3 250-300 mg/m^3 (off gas)	No data
Slovakia	SO_2	<500 mg/m3 (<100 mg/m^3 with wet FGD)	400 mg/m^3	179-196 mg/m^3
Spain	SO_2	<500 mg/m3 (<100 mg/m^3 with wet FGD)	1000 mg/m^3	391-619 mg/m^3
Italy	PCDD/PCDF	0.1-0.5 $ngTEQ/m^3$	0.4 $ngTEQ/m^3$	No data
Netherlands	PCDD/PCDF	0.1-0.5 $ngTEQ/m^3$	0.4 $ngTEQ/m^3$	0.4 $ngTEQ/m^3$
Slovakia	PCDD/PCDF	0.1-0.5 $ngTEQ/m^3$	None	No data
Spain	PCDD/PCDF	0.1-0.5 $ngTEQ/m^3$	0.5 $ngTEQ/m^3$	No data
Blast furnace				
Italy	Dust	<10 mg/m^3	10 mg/m^3	1.5-2.3 mg/m^3
Netherlands	Dust	<10 mg/m^3	5-15 mg/m^3	<1-10 mg/m^3
Slovakia	Dust	<10 mg/m^3	100 mg/m^3	0.4-36 mg/m^3

Member State	Pollutant	BAT-AEL (Note 1)	Permit ELVs (Note 1)	Actual emissions (Note 1)
Spain	Dust	<10 mg/m^3	40-120 mg/m^3	1-7 mg/m^3
Italy	NO_x	<350 mg/m^3	350 mg/m^3	5-16 mg/m^3
Netherlands	NO_x	<350 mg/m^3	40 mg/m^3	No data
Slovakia	NO_x	<350 mg/m^3	500 mg/m^3	11-50 mg/m^3
Spain	NO_x	<350 mg/m^3	300ppm (564 mg/m^3)	<5ppm (<9 mg/m^3)

Notes:

1) Where there are several points at which emissions are measured and ELVs set, the range is quoted. It was concluded in the BREF that it was not possible to draw a conclusion on what averaging periods should be used, though there was a recommendation that the BAT-AELs should be considered as daily averages unless otherwise stated. BAT-AELs for dust emissions with fabric filters in place and SO_2 emissions with wet FGD are also quoted above. It is understood that fabric filters will be in place at the Italian installation.

A summary of the overall analysis for these installations is included in Appendix H of this report.

3.5 Production of basic inorganic chemicals (nitric acid manufacture)

3.5.1 Sector background

According to the BREF on large volume inorganic chemicals, nitric acid is one of the top 10 industrial chemicals, with production of 16.6 million tonnes in Europe in 2003 and around 100 nitric acid manufacturers in the EU25 plus Norway and Switzerland in 2006.

Most nitric acid is manufactured through oxidation of ammonia with air to form nitrogen oxides that are absorbed in water to form nitric acid.

The majority of nitric acid use is in production of inorganic fertilisers, ammonium nitrate explosives and in chemicals. Weak nitric acid (50-65%) constitutes the greater part of nitric acid manufacture and is suitable for production of fertilisers; stronger acid (up to 99%) is used for many organic reactions.

Weak acid can be produced using either a monopressure process (medium or high pressure) or a dual-pressure process (with medium pressure front end for ammonia oxidation and high pressure tail end for absorption (Kirk Othmer, 2005). The different plant types are illustrated in the table below.

Table 3.13 Different plant types for the production of HNO_3 (LVIC BREF)

Column Heading	Applied Pressure in bar	
	Oxidation	Absorption
Dual Low/Medium (L/M)	<1.7	1.7 – 6.5
Mono Medium/Medium (M/M)	1.7 – 6.5	
Dual Medium/High (M/H)	1.7 – 6.5	6.5 – 13
Mono High/High (H/H)	6.5 – 13	

3.5.2 Key environmental issues and BAT

In terms of the key environmental issues, considerable amounts of the greenhouse gas N_2O are generated during nitric acid production; oxidation of ammonia generates NO, with N_2O as a by-product. Increases in combustion pressure from 1 to 5 bar in recent decades have slightly increased the N_2O emission level. The average European plant emits 6 kg of N_2O per tonne of HNO_3 corresponding to about 2 tonnes CO_2-eq. per tonne of 100% HNO_3.

The other main pollutant emitted to air is NO_x. Ammonia emissions also have the potential to be significant.

Table 3.14 Raw materials and key environmental issues

Raw Material	Production of ...	Major issues
Air, NH_3	HNO_3	Energy export Air: N_2O, NO_X

A summary of the best available techniques for nitric acid is provided in the table below. For further information, the reader should consult the BREF on large volume inorganic chemicals.

Table 3.15 Generic and Process-Specific BAT techniques from the BREF on Large Volume Inorganic Chemicals

Element	BAT
Use of recoverable energy	Co-generated steam and/or electrical power
Reduce emissions of N_2O to achieve emission factors given in Table X.4 through a combination of …	Optimising filtration of raw materials Optimising the mixture of raw materials Optimising the gas distribution over the catalyst Monitoring catalyst performance and adjusting campaign length Optimisation of the NH_3 /air ratio Optimising the pressure and temperature of the oxidation step N_2O decomposition by extension of the reactor chamber in new plants Catalytic N_2O decomposition in the reactor chamber Combined NO_x and N_2O abatement in tail gases
Reduce emissions of NO_X during start-up and shutdown processes to achieve emissions levels given in the table below through a combination of …	Optimisation of absorption stage Combined NO_x and N_2O abatement in tail gases Selective catalytic reduction (SCR) Addition of H_2O_2 to the last absorption stage

3.5.3 Main emissions and levels associated with BAT

The information on the main emissions and levels associated with BAT are taken from the BREF on Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers (August 2007). The following tables describe the BAT-AELs for emissions of N_2O and NO_x to air from this sector, taking into account the techniques listed above.

Table 3.16 BAT Associated Emission Levels (AELs) for emissions of N_2O to air

		N_2O emission level	
		Kg/tonne 100% HNO_3	ppmv (mg/Nm^3)
M/M, M/H, and H/H	New plants	0.12 - 0.6	20-100
	Existing plants	0.12 - 1.85	20-300
L/M plants		No conclusion drawn	
Averaging periods: The levels relate to the average emission levels achieved in a campaign of the oxidation catalyst.			

Table 3.17 BAT Associated Emission Levels (AELs) for emissions of NO_x to air

	NO_X emission level as NO_2	
	Kg/tonne 100% HNO_3	**ppmv**
New plants	-	5 – 75
Existing plants	-	5 – 90
NH_3 slip from SCR	-	<5
Up to 150ppmv, where safety aspects due to deposits of AN restrict the effect of SCR or with the addition of H_2O_2 instead of applying SCR. No information is provided on averaging periods for the BAT-AELs for NO_x emissions in the LVIC BREF.		

3.5.4 Case study 1 – Italy

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/IT/09. The information in this table is based on the detailed assessment for this installation in Appendix D1. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation/application	The installation is a listed activity as defined within Annex 1, Point 4.1 *"Chemical installations for the production of organic chemicals'* and Point 4.2(b) *'Chemical installation for the production of basic inorganic chemicals'* of the IPPC Directive. The installation uses the classic method of nitric acid manufacture, which involves high temperature catalytic oxidation of ammonia, which generates nitric oxide (NO). The NO is then oxidised to form nitrogen dioxide (NO_2). The next stage is absorption where the NO_2 is dissolved in water to produce nitric acid. This plant is classed as a dual low/medium process (related to pressure applied in the oxidation and absorption stage). The installation produces three different final products: ▪ Nitric acid in 65% water solution still containing nitrogen oxide and used for production of adipic acid. ▪ Nitric acid in 65% water solution ▪ Nitric acid in 53% obtained by dilution of the nitric acid above. Emissions of NO and NO_2 within the tail gas from the nitric acid manufacturing process are abated by means of selective catalytic reduction (SCR). The Nitric Acid plant dates from 1972.
Type of permit/issue date	This was a new permit for an existing installation. Previously the installation had been regulated separately for emissions to air and to water under separate, pre-existing, regulatory regimes. The permit was issued by the competent authority in September 2007.
Basis of BAT determination	The BREF document for *Large Volume Inorganic Chemicals – Ammonia, Acids & Fertilisers* was used by the operator for the determination of BAT. In relation to emissions to water, ELVs are set out in national legislation and as such constitute GBRs.

Permit application	
Requirements of Article 6	The operator used the electronic template provided by the provincial authority to make their application. This template had been developed to take into consideration all Article 6 requirements. In order to conduct a full BAT assessment the competent authority required clarification on some of the information that had been provided within the operator's application and this was done through two formal requests for information. The information provided by the operator to address the formal request for information was considered by the competent authority in the writing of the permit.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The main body of the permit includes two main sections. The **Executive** section includes details on the legislative framework of IPPC with reference to the appropriate BREF and Italian guidance for IPPC Implementation. This section of the permit also provides information on the competent authorities involved during the determination process, details of timescales of determination and public consultation. It also provides information on the validity of the permit. The **Determination** section describes the conditions under which the permit is granted and is supported by two technical attachments, A and B. This section approves the technical and management techniques described in the application and specifies the previous authorisations being superseded by the current permit and defines the timescales of the transition between the old and the current permitting regime. Appendix A of the permit provides the prescriptive requirements and Appendix B of the permit provides details of the emission points to air and associated ELVs. Conditions are included in Appendix A of the permit that address the requirements of Article 3, including pollution prevention, waste avoidance, recovery and disposal, energy efficiency, accident prevention and site closure.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** Within Appendix B of the permit, a table summarises the ELVs that have been set for the air emission points from the installation and includes those from the nitric acid plant. **Water:** While no specific ELVs are included within the permit for emissions to water, reference is made to the need to comply with the ELVs documented within national legislation D. Legs 152/06 Table 3, Appendix 5 which relate to the discharge to watercourses. **Land:** No ELVs have been set for emissions to land. **Protection of soil and groundwater** The nitric acid manufacturing plant is bunded and all hardstanding is designed to ensure no contamination to ground. The permit sets out requirements for tanks, bunds and vat integrity to be verified and the records of the check to be documented and kept for the competent authority to examine. **Waste** The permit sets out requirements for the operator to comply with D. Legs 52/06 decree, Article 83, regulating the temporary storage of waste on-site. According to this GBR, waste temporarily stored shall not contain more than 2,5 ppm of PCDD, PCDF or PCD-phenols nor more than 25 ppm of PCB and PCT. A schedule for recovery or disposal shall be prepared for hazardous and non-hazardous waste. Recovery or disposal will be carried out on a time schedule or whenever a storage threshold is reached. Temporary storage will be executed by waste category and in observance of technical regulations. For hazardous waste, the regulations related to the individual hazardous chemical species in the waste will also have to be complied with. Containment and signage for hazardous waste will have to be carried out in observance of the relevant regulations. **Transboundary considerations** Due to the distance of the installation from the nearest country boundary, transboundary pollution has not been taken into consideration in this permit. **Further equivalent technical parameters/measures** The operator is required to carry out visual checks of the river into which the installation discharges in order

	to determine if there is any change in water quality, downstream of the water discharge point. The permit sets out requirements in relation to noise. Specifically the operator is required to be in compliance with the limits provided within the acoustic zoning prepared by the town council (Commune).
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** The main environmental impacts associated with the manufacture of nitric acid are the generation of air emissions, specifically NO_x and N_2O. Within this installation, selective catalytic reduction (SCR) is installed to abate NO and NO_2 emissions generated within the tail gases from the manufacture of nitric acid. This type of abatement equipment and its efficiency of 80% NO_x removal, as reported by the operator are in line with BAT as described in the BREF document (NO_x conversion of 80 - 97 % can be achieved according to the LVIC BREF). The permit ELVs set for the SCR emission point however are not in line with the BAT-AELs. There is no mention in the permit of emissions of N_2O associated with nitric acid manufacture. In the documents supporting the permit application, the operator has reported to the competent authority that as the technology used for manufacturing nitric acid involves low-pressure combustion of ammonia there are resulting low concentrations of N_2O emissions. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** There is no evidence of consideration of specific technical characteristics, geographic location or local environmental conditions. **Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?** None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** None observed.
Use of relevant BREF documents in setting permit conditions?	The permit lists the following BREF documents as having been examined by the competent authority in the development of the permit: ▪ Industrial Cooling Systems ▪ Emissions from Storage ▪ Common Waste water and Gas Treatment/ Management in the Chemical Sector ▪ Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers It is recorded in the permit that plant and management techniques conform to these BREF documents. There is documented evidence that BAT, as described in the LVIC BREF document, was considered during the Conference of Services in relation to assessing the efficiency of the catalytic abatement equipment. The 'conference of services' is a meeting set up by the competent authority, and to which are invited other competent administrators in environmental matters, for the purpose of approving the permit release. Meeting minutes show that the efficiency of the catalytic abatement equipment was considered and it was reported that the efficiency of the existing plant exceeded that recorded within the BREF document.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Appendix A of the permit contains a section entitled Plan of Monitoring and Control. This section of the permit sets out requirements for the operator to supply monitoring data to the competent authorities. The permit sets out requirements for monitoring to be carried out by the operator or a third party contractor, to standard analytical methods and using accredited laboratories. For the two emission points associated with the nitric acid manufacturing process, emissions of NO_x are required to be monitored on a continuous basis and this is documented within the permit. **Are the monitoring requirements sufficiently detailed?** There is no direct reference within the permit to monitoring techniques or to frequency; however the permit does report that the methods and timescales to be applied are the ones proposed by the operator in the application.

	Do the monitoring requirements take into account the details contained within the BREF documents? The BREF document determines it essential for the performance of the platinum/rhodium catalyst, used in the catalytic oxidation of ammonia and air, to be monitored (e.g. by monitoring N_2O emissions). In addition the BREF document describes BAT as the monitoring of key performance parameters and to maintain mass balances. The permit sets out requirements for the operator to monitor energy consumption. While there is no specific monitoring described in relation to the catalyst the permit does set out requirements for optimisation of the catalytic plant for NO_x abatement. There is no requirement in the permit to monitor N_2O emissions from the nitric acid manufacturing process (however, there is monitoring of emissions associated with the adipic acid process).
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	The permit makes reference to the possible increase in air emissions during start up and shut down of the nitric acid plant. The permit sets out requirements for the operator to provide quantitative data on the emissions generated during these steps in order for ELVs to be set accordingly. The permit requires the competent authority to be notified within 8 hours of the abatement plant malfunctioning. In the event that the operator cannot guarantee that the ELVs will be met then the processing plant is to be shut down.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** The ELVs for discharges to water from this installation are based on this national legislation. Reference to this legislation is made within the permit.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** It was reported by the competent authority that there are no EQSs relevant to this installation that required stricter conditions than those achievable by the use of BAT.
Inclusion of information on period of validity of permit and when it will be reconsidered/updated (Article 13)	The permit details an expiry date which is 5 years from permit issue and sets out requirements for the operator to submit an application for renewal 6 months before the expiry date. This timescale is as defined within national legislation. As the permit was only issued in September 2007 it will not require reconsideration until September 2012.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The operator placed an advertisement in a national newspaper 15 days after submission of the application, in line with legal requirements. Following the publishing of the advert, the public had a period of 30 days in which to view the application and provide comments. The permit states that copies of the permit will be transmitted to the communal authorities, ARPA and ASL and made available for public consultation in the Province office. The competent authority reported that the application, permit and other supporting documentation would be made available to the public on request. **Are monitoring records made available to the public?** Information on monitoring is currently made available to the public on request. There is a plan for future monitoring information to be made available on the competent authority's website.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The operator carries out continuous monitoring of NO_x on the two air emission points associated with the nitric acid manufacturing process. In addition, the operator conducts daily monitoring of the emissions from the on-site wastewater treatment plant to watercourse (river). The operator measures compliance with noise limits defined within legislation following every plant modification and conducts noise surveys every four years. There is also ongoing process monitoring across the whole site, which is connected to a central control

	system.
Operator's compliance with monitoring conditions	The monitoring, which is conducted on-site complies with the requirements of the permit conditions.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	Historical monitoring information has not been made available. However both the operator and competent authority reported that emissions associated with the nitric acid manufacturing process have not changed since before permit issue.
Current emissions of key pollutants	This information is provided within the table below.
Assessment of installation performance against BAT	**Current performance:** In relation to air emissions, the operator and competent authority reported no areas of non-compliance with the ELVs set within the permit. However emissions of NO_x from the SCR appear to exceed the BAT-AEL specified within the BREF document.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The permit sets out requirements for a site closure plan to be submitted to the CA at least 6 months prior to the site final closure. During site closure it is recognised by the operator that there is the potential for land contamination and waste production. Documented procedures are in place at the installation in relation to clean up. Specifically for the nitric acid plant there are procedures in place for the emptying, venting and remediation of receptacles and containers. To prevent land contamination, all process areas are situated on hardstanding, which is specifically designed to ensure no contamination from the on-site activities.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The permit sets out requirements for the competent authority (ARPA) to conduct an annual inspection of the installation. In addition ARPA (the regional agency for environmental protection), will conduct audits under pre-existing regimes that will involve assessing emissions to air and water, including spot sampling. The operator is required to submit an annual monitoring report to the provincial authority, ARPA, ASL (local health authority) and the town council for review. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** No sanctions have been applied. In the event that non-compliance is identified, ARPA would report this to the Provincial authority. A notice would then be issued requiring action to be taken to rectify the non compliance against a set timescale. In the event that action is not taken as required, then operation of the plant may be suspended and the permit withdrawn. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** Several years of regulation as a top-tier COMAH (Seveso II) site have helped ensure that good management systems are in place to ensure compliance with the permit. The operator has a number of measures in place to ensure compliance: ▪ Management system procedures are in place for auditing and recording of non-conformances and corrective/preventive actions in line with ISO14001 requirements. ▪ Annual monitoring of air emissions by a third party consultant. ▪ Continuous monitoring of air emissions from the two emission points associated with the nitric acid manufacturing process. ▪ Real-time process monitoring. ▪ Monthly monitoring of energy, catalyst performance, water consumption, waste production. Any discrepancy in the data would require internal investigation. **Procedures used or action taken by the operator in the event of non-compliance** In the event of non-compliance, specifically a breach of the ELVs, the charge hand is required to report

	this to his Line Manager who in turn would report it to the Site Manager. The Site Manager is responsible for communicating details of any IPPC non-compliance to the competent authority.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** ARPA are required to conduct annual inspections of this installation. In addition ARPA are still conducting inspections in line with the previously regulatory regime. This inspection frequency is deemed by the competent authority to be typical for this type of installation; although it is a large installation its management systems are deemed by the competent authority to be well developed for ensuring regulatory compliance (and the inspection frequency may thus be judged to be based on risk). (The yearly frequency for ARPA inspections stems from an agreement between ARPA and the Provincial government (Competent Authority). There are no national laws or ARPA internal regulations prescribing the frequency. The yearly frequency has been decided considering, amongst other factors, the cost of the inspection which is sustained by the operator. At present all the installations are inspected yearly and there is no reference to risk factors, even though ARPA would be inclined to inspect some installations more frequently, on a risk basis (as described above). This regime of annual inspections is more strict than the minimum requirement of two visits during the duration of the Permit suggested in the ministerial guidelines dated 31 Jan 2005 "(Linee Guida per i Piani di Monitoraggio di Impianti IPPC").) At the time of the site visit, no inspection of the installation had taken place since permit issue. In the event of an inspection the operator would assist the competent authority. The inspection is likely to be unannounced and is expected to take one whole day. As part of the inspection ARPA may take spot samples. The permit sets out a need for the operator to notify the competent authority/ARPA 15 days before any self-monitoring so that they may attend.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Results of monitoring are available upon request.

Key observations from this case study assessment

- Several years of regulation as a top-tier COMAH (Seveso II) site have helped ensure that good management systems are in place to ensure compliance with the permit.
- The installation is compliant with the ELVs set within the permit for emissions to air. These ELVs are less stringent than the BAT-AELs and it appears, from analysis of the monitoring data provided by the operator that the emissions of NO_x from the emission point associated within the SCR exceed the BAT-AEL specified within the BREF document. The SCR is reported by the operator to have a NO_x removal efficiency of 80%. This is in line with the NO_x conversion of 80 - 97 % which can be achieved, with this type of abatement, according to the LVIC BREF
- The permit does not include ELVs for N_2O emissions and no monitoring data on N_2O emissions from the nitric acid process has been provided, although there is a pilot plant in place for catalytic destruction of N_2O from the associated adipic acid process, which generates a significantly higher quantity of N_2O emissions.
- No monitoring data were made available for emissions to water so it has not been possible to assess performance of the installation against permit ELVs (which are from GBRs) or BAT-AELs.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
E1 (vents from storage tanks via scrubber with H_2O_2)	NO_x	117 mg/m^3 (57ppm)	400 mg/m^3 (195ppm)	5-150ppm	Yes	Yes	EPA-CTM030	30 min average (same as permit; averaging period not specified in LVIC BREF)	T=273K P= 101,3kPa
E1b (tail gas treatment via SCR)	NO_x	302 mg/m^3 (147ppm)	450 mg/m^3 (219ppm)	5-90ppm	Yes	No	EPA-CTM030	30 min (same as permit; averaging period not specified in LVIC BREF)	T=273K P= 101,3kPa
	NH_3	0.1 mg/m^3 (0.2ppm)	10 mg/m^3 (22 ppm)	<5ppm	Yes	Yes	EPA-CTM030	30 min (same as permit; averaging period not specified in LVIC BREF)	T=273K P= 101,3kPa
Emissions to water									
Wastewater treatment plant[2]	COD	Not available	≤ 160	30-250	Unknown	Unknown	-	See note 4	-
	BOD_5	Not available	≤ 40	N/A	Unknown	Unknown	-	See note 4	-
	NO_2-	Not available	≤ 0.6	5-25[3]	Unknown	Unknown	IRSA 4050	See note 4	-
	NO_3-	Not available	≤ 20		Unknown	Unknown	IRSA 1020	See note 4	-

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	NH_3-	Not available	≤ 15		Unknown	Unknown	IRSA 4030	See note 4	-
	pH	Not available	5.5-9.5	N/A	Unknown	Unknown	IRSA 2060	See note 4	-
	Iron	Not available	≤ 2	N/A	Unknown	Unknown	-	See note 4	-
	Copper	Not available	≤ 0.1	N/A	Unknown	Unknown	-	See note 4	-
	Vanadium	Not available	-	N/A	Unknown	Unknown	-	See note 4	-
	Nickel	Not available	≤ 2	N/A	Unknown	Unknown	-	See note 4	-
	Chromium	Not available	≤ 2	N/A	Unknown	Unknown	-	See note 4	-
	Aluminium	Not available	≤ 1	N/A	Unknown	Unknown	-	See note 4	-

Notes:

1 The BAT-associated emission levels are taken from the BREF Document for 'Waste Water and Waste Gas Treatment'

2 The wastewater treatment plant serves the whole chemical plant and not just the nitric acid manufacturing installation.

3 This figure relates to a sum or NH4-N, NO2-N and NO3-N (a more recommendable parameter would be total N. because of the lack of information on total N, total inorganic N is used here)

4 For emissions to water, the relevant GBR specifies a 24h measurement period. The LVIC BREF does not specify averaging periods.

Dashes indicated that no data were available.

Emissions to land
Notes: Not applicable.

3.5.5 Case study 2 – Netherlands

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/NL/28. The information in this table is based on the detailed assessment for this installation in Appendix D2. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation/application	The installations produces ammonia, ureum, nitric acid and fertilisers. Only the nitric acid production has been the target of the assessment. The plant is an existing plant, with the first permits issued in the 1980s. According to the permit application of 2005 and the IPPC evaluation document, the site comprises 2 nitric acid production units. The installation also includes production of phosphorous, nitrogen- or potassium-based fertilisers (Point 4.3 of the IPPC Directive and combustion installations with a rated thermal input exceeding 50 MW (ammonia stoves and combustion installations of the power plant) (Point 1.1 of the Directive).
Type of permit / issue date	The general permit was issued on 29 November 1995 and is still valid. The company was invited by the Competent Authority (CA) to perform an IPPC-evaluation in a separate evaluation document. The assessment concluded that the installations were not entirely in line with General Binding Rules (which were modified to be in accordance with the IPPC Directive). As a result of this evaluation, the CA has modified the permit conditions in the Decree of 12 September 2008. At the time of the site visit and assessment, the permit for the waste water discharge was being updated to put the permit conditions in line with the BREF BAT-AEL-ranges. Due to a limited treatment and a local cooling water problem, the waste water from the installation is an issue of major concern to the CA and will demand detailed study. As there has been less focus from the CA on wastewater discharge issues to date, this issue has not been a major concern to the operator.
Basis of BAT determination	The BAT evaluation was performed in 2007. The permit of 2008 mentions that the BAT determination is based on the BREF documents.
Permit application	
Requirements of Article 6	The application met the Article 6 requirements with the exception of the description of the site condition, the descriptions of the main alternatives and a non-technical summary. This situation has not been rectified.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** All items of Article 3 of the Directive are covered in the 2008 modified permit: pollution prevention measures, measures to make sure that no significant pollution is caused, measures for waste avoidance, recovery and disposal, energy efficiency measures, accident prevention measures and site closure measures.

Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	ELVs for emissions to air (NOx, N_2O, NH_3, dust) are set in the permit. ELVs for discharges to water are set in a separate permit. No ELVs for emissions to land are included. In relation to protection of soil and groundwater, there are provisions requiring: In case of soil contamination, the operator needs to take the necessary measures to prevent further contamination and to organise appropriate remediation to treat the polluted area; Measures for storage of liquids to prevent soil or water contamination; Requirements for the storage of dangerous substances (products and waste materials). Potential soil polluting activities need to be organised in such a way as to minimise the risk of soil pollution to a negligible level (according to a judgement system as developed in General Binding Rules). If the operator does not reach the negligible level, they must propose a programme to achieve this level. For waste, the permit includes requirements to provide the CA with an overview of the waste materials produced and disposed of on an annual basis. There is no information in the permit on potential transboundary effects.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** The ELVs are in line with the BAT-AELs. ELVs in the Netherlands are normally selected as the most stringent of either the BAT-AELs or those in the GBRs. GBRs are based on BAT but also take into account requirements from other legislation (e.g. the NEC Directive) and experience from the CA and within the sector. The operator of the installation performed a BAT assessment in 2007; based upon this, the permit conditions have been updated.
	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? The specific technical characteristics of the installation have been taken into account, meaning that older installations were granted a transition period to be in line with BAT.
	Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)? No
Use of relevant BREF documents in setting permit conditions?	For the setting of the permit conditions, the BAT-AELs as well as the feasibility of achieving these BAT-AELs have been taken into account. The installation has performed a BAT assessment in 2007, based upon which the permit conditions have been updated. For each activity, the application of BAT is checked and the emissions of the installations are compared to the BAT-AELs.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The operator and the CA have agreed on measurement methodology, evaluation and reporting. Monitoring is performed according to Dutch national standards (NEN), except for emissions of NO_x and CO_2 to air, which are governed by the requirements of the national and EU emissions trading systems for these parameters respectively. **Are the monitoring requirements sufficiently detailed?** Yes, permit conditions fix monitoring frequency and methodology as well as the methodology for checking against the ELVs are included. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** Yes. However, emissions monitoring for NO_x and CO_2 are set out in the emissions trading schemes for these substances. It is expected that monitoring of N_2O emissions will also be covered as such in the near future. **Does the permit include information on duration in relation to monitoring requirements?** Yes

Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Yes. There is a requirement to notify the CA in case of other than normal operation conditions and to take measures to ensure that the impact on the environment during such conditions is kept to a minimum.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes, the emissions to air are implemented by GBR that have been determined taking into account BAT. In the Netherlands, permit ELVs are always based on the most stringent of the BAT-AELs and ELVs set out in GBRs, where GBRs are not only based on BAT but also on the requirements of other regulations (e.g. NEC Directive) and the experience of CA and within the sector.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** Due to local environmental issues the CA has imposed some ELVs which are more stringent than the upper end of the BAT-AEL ranges (for example, NOx ELVs of 40 mg/Nm^3 from nitric acid manufacture).
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	Although no expiry date is mentioned in the permit, the CA's quality system foresees a re-evaluation of the permit conditions at least every 6 years.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The application and the permit were made available on a public register for a period of 1.5 months after the date of issuing of the permit. It is unclear whether the permit application is still publicly available after granting of the permit. The permit is publicly available upon request. **Are monitoring records made available to the public?** The non-confidential part of the annual environmental report is publicly available.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The most significant pollutants from the most significant sources to air are monitored continuously (e.g. NOx from nitric acid manufacture) or monthly by spot samples (e.g. N_2O), while other pollutants/sources are sampled and analysed only a couple of times a year. Emissions to water are sampled and analysed on a regular basis (COD and N-compounds daily, metals once every 2 months). Details are set out in the table below.
Operator's compliance with monitoring conditions	The emission monitoring currently complies with the permit conditions.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	These data were not made available.
Current emissions of key pollutants	This information is provided within the table below. Air emissions data were only provided for one of the two nitric acid plants. For this plant, emissions of NOx and N2O were within the BAT-AEL range and below the permit ELVs. For the other nitric acid plant (where no monitoring data were provided), the permit ELV for NOx is set near to the middle of the BAT-AEL range (40 ppmv) and that for N2O is set at the upper end of the range (average 300 ppmv). In relation to emissions to water, data provided for Kjeldahl-N were 50 mg/l compared to the permit ELV of 250 mg/l; emissions of total N were above the permit ELV of 500 mg/l; and emissions for COD were also above the permit ELV of 220 mg/l (there is no BAT-AEL for these parameters).

Assessment of Installation performance against BAT	The measurements for the emissions to air comply with the permit ELVs and are in line with the BAT-AELs. The emissions to water exceed the permit ELV for total N and COD; this problem is currently under consideration by the operator and CA.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	These measures are governed by GBRs. GBRs mainly relate to soil where the operator has to assess soil quality upon cessation of the activities and is responsible for soil sanitation in case contamination has been found.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** • Regular inspections • Review of the environmental report • Independent sampling and analysis **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** An official warning (formal enforcement letter) has been sufficient to deal with the minor non-conformity incidents detected so far (e.g. spot samples occasionally exceeding permit ELVs). **Procedures and/or systems used by the operator to ensure compliance with permit conditions** • Internal audits on safety and environmental issues • The environmental coordinator regularly makes a site tour • Measurements/Monitoring • Audit by the parent company, which takes place every 2 years **Procedures used or action taken by the operator in the event of non-compliance** The operator aims to solve the non-compliance as soon as possible and communicates with the authority about the actions taken.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** There are 12 - 15 inspections each year. It is unclear on what basis this frequency has been determined.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** The non-confidential part of the annual environmental report is publicly available. The loads to air and water of large installations are made publicly available on a central website (emissieregistratie.nl).

Key observations from this case study assessment

The company has performed a BAT-evaluation based on the BREF documents on the invitation of the Competent Authority, in a separate document (no running permitting procedure). This evaluation resulted in a permit change (on the CA's initiative), which was issued on 12 September 2008 (past the IPPC-deadline).

The IPPC permit covers all requirements of the IPPC Directive. The ELVs for air emissions, which have become more stringent since issue of the IPPC permit, are in line with or at the lower end of the BAT-AELs. These were set taking the feasibility of meeting these ELVs into account, given that this is an existing installation. Although the operator states that there is a very strict interpretation of the BREF ranges while setting the ELVs, both parties confirm a good and frequent dialogue where there is room for compromise.

Where data are available, the monitoring results suggest that emissions are compliant with the permit ELVs and below the upper end of the BAT-AEL ranges (where applicable), with the exception of COD to water.

The permit for the waste water discharge is currently being updated to put the permit conditions in line with the BAT-AEL ranges. Due to a limited treatment and a local cooling water problem, the waste water of the company is an issue of major concern to the CA and will demand detailed study. This issue is one of the reasons why the contact between the operator and this CA is reported to be difficult.

The CA follows a detailed inspection programme containing frequent site visits and regular discussions between both parties. There is a good follow-up of the fulfilment of permit conditions. On the other hand, according to the operator, there is no regular follow-up of the waste water discharge. This may explain why the waste water problem (breach of permit ELVs) is not experienced as such by the operator, because attention is not being focused on this problem (a lack of control of the water emissions and a delay in IPPC-implementation for this issue are the reason why the operator does not pay sufficient attention to this problem).

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods (examples, further details are provided in Appendix D2)

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Nitric acid 7	NOx	28.36 ppmv	40 ppmv	5 – 90 ppmv	Yes	Yes	NM	Half hour (Note 1)	
	N2O	216 ppmv	1000 ppmv (max) 300 ppmv (avg)	20 – 300 ppmv	Yes	Yes	NM	Half hour (Note 1)	
Notes: 1) Averaging periods relate to actual monitoring and permit requirements. Averaging periods are not specified in the LVIC BREF.									
Emissions to water									
	N Kjeldahl	50 kg/d	250 kg/d	N/A	Yes	N/A	NEN 6481	Day (Note 2)	
	Tot N	861 kg/d	500 kg/d	N/A	No	N/A	NA	Day (Note 2)	
	COD	581 kg/d	220 kg/d	N/A	No	N/A	NEN 6633	Day (Note 2)	
Notes: 2) Averaging periods relate to actual monitoring and permit requirements. Averaging periods are not specified in the LVIC BREF.									
Emissions to land									
Not applicable									

3.5.6 Case study 3 – Spain

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/ES/32. The information in this table is based on the detailed assessment for this installation in Appendix D3. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is a Nitric Acid and Fertiliser Manufacturing Plant falling under Annex 1 Category 4.3 'Chemical Installations for the production of phosphorus, nitrogen or potassium-based fertilisers (simple or compound fertilisers') of the IPPC Directive and national GBR 2/2006, which implements the requirements of the IPPC Directive at a regional level. The installation also falls under the Category 4.2 b 'Chemical installations for the production of basic inorganic chemicals, such as: nitric acid'. The main activities of the installation include the production and dispatch of nitric acid, production of solid nitrogenated fertilisers, fusion of ammonium nitrate and nitrogenated solutions and calcium nitrate using anhydrous ammonia as a raw material. The installation is a Dual Medium/High (M/H) pressure plant. The annual production at the installation is 1,114,955 tonnes/year.
Type of permit / issue date	This is a new permit for an existing installation. The permit also covers the extension of plant to include the following activities: production of calcium nitrate and the storage of ammonium nitrate, nitric acid and calcium nitrate. The permit application was submitted on 17th October 2006. The permit was signed on 29th July 2008 and formally issued to the Operator on 1st August 2008.
Basis of BAT determination	The Competent Authority stated that the relevant national and regional legislation, the BREF for *Large Volume Inorganic Chemicals- Ammonia, Acids and Fertilisers' (2007)* (LVIC) and guidance provided by the Government Department called the *Clean Technology Centre,* were considered when setting permit conditions. The Operator provided a BAT assessment for each of the main processes and the Competent Authority reported during the interview that they assessed this information against the limits in national and regional legislation, but did not undertake a direct assessment of BAT themselves.
Permit application	
Requirements of Article 6	A check of the component aspects of the Operator's application for an IPPC permit was undertaken as part of this assessment, and showed that the requirements of Article 6 were met. There were a number of requests for further information during the permit determination process, to support the application. These requests were for general data and submission of studies, including an acoustic study as part of the EIA for the extension of the activities at the installation.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The assessment of this installation has shown that conditions are included within the permit that governs the basic obligations of the Operator according to Article 3. The primary condition in the permit relates to the requirement for the Operator to fulfil measures to ensure compliance with the GBRs 2/2006 and 127/2006, which implement the requirements of the national legislation on IPPC 16/2002. This is supported by a number of specific conditions in the permit to prevent pollution.

Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** Section 1.1 of the permit contains ELVs for point source emissions to air. One of the main findings from this case study has been that there are no ELVs set within the permit for emissions of the greenhouse gas N_2O. This pollutant is generated during the oxidation of ammonia stage and, according to the LVIC BREF, this is the most significant air pollutant emitted from this industry. There is continuous emissions monitoring in place for this pollutant and an N_2O analyser has recently been installed. The Competent Authority commented that once the catalyst is embedded and, based on monitoring data for the resultant N_2O emissions, ELVs for this pollutant will be included within the permit. For further information see Question 6 of the detailed report. An ELV for NH_3 emissions from the nitric acid plant stack has not been included in the permit. The Operator has continuous monitoring in place for this pollutant in the tail gases. The BREF provides a BAT-AEL of 5-30 mg/Nm^3 for NH_3 emissions. ELVs for NO_x (expressed as sum of NO and NO_2) have been included within the permit. The permit contains the condition that the total NO_x must not exceed 100ppmv. **Water:** ELVs for emissions to water (sea) have not been included within the permit. Emissions to water were regulated under a separate authorisation and by a separate authority (Conselleria of Public Works, Urbanism, Transport) and the discharge conditions within this authorisation still apply, until the expiration of the authorisation (on 23/11/ 2012) or until the Competent Authority make a decision on whether the conditions are appropriate following a report by the operator within 3 months of permit issue (by Nov 2008)The permit contains references to the relevant GBRs that must be complied with for discharges to sea. **Land:** Emissions to land are not authorised under this permit. **Protection of soil and groundwater:** Emissions to soil and groundwater are not authorised under this permit. **Transboundary considerations:** The permit does not specifically contain conditions that relate to transboundary impacts and minimisation of transboundary pollution. There is no evidence of the transboundary impacts of N_2O or NO_x emissions from the installation having being considered in the determination of the permit. There is a reference in the permit to the requirement for the Operator to provide annual emissions data for inclusion within the European Pollutant Release and Transfer (EPRTR). **Energy Efficiency:** There are no conditions within the permit to address energy efficiency. The Competent Authority stated that the Operator is very energy efficient already and there was no requirement for additional conditions to be included. The Operator has an energy recovery system in place and the installation produces sufficient electrical energy to supply all the company's needs and also exports electrical energy to the national grid.

Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** Many of the conditions contained within the permit are clearly based on BAT. There are a number of areas where it is considered that BAT is not being applied, or where conditions have not been based on BAT, which are outlined below. As discussed above, there are no ELVs set within the permit for emissions of N_2O and no further conditions that consider BAT for control of this pollutant. The Operator subsequently provided some clarification on the issue. Limits have not been set for this pollutant for other facilities in the Member State and therefore, according to them, these could not reasonably be included within this permit. They also commented that there is considerable uncertainty around the technologies for abatement of N_2O within Nitric Acid plants; according to the operator, they are either not sufficiently proven or could not be applied for this particular installation. They are currently running catalyst trials for the abatement of N_2O and the percentage reduction of N_2O will be approximately 73%. This type of alternative oxidation catalyst (improved platinum-based catalyst) is considered as BAT within the LVIC BREF. However, according to the Operator, this technology requires a considerable settling in period (approximately 1 year) and they expect to only see reductions in emissions from August 2009. This, the Operator concluded is the main reason why it would not have been appropriate to include limits within the permit prior to the installation of this abatement technique, as the Operator does not have an accurate indication of how much N_2O they will be emitting once the technology is fully settled in and working. The Competent Authority commented that once the catalyst is embedded and, based on monitoring data for the resultant N_2O emissions, ELVs for this pollutant will be included within the permit. An ELV for particulate emissions exceeds both the limit set within the relevant GBRs and BAT-AEL. The Competent Authority stated that this limit was proposed by the Operator and was accepted because the Operator provided justification that it was not technically feasible to achieve the 30 mg/Nm^3 limit. The Competent Authority carried out a cost-benefit assessment on the replacement of the existing cyclone abatement equipment and concluded that the whole technology/equipment would need to be changed; replacement of the cyclone would not achieve significant reductions in particulates to allow them to meet the GBR limit. Replacement of the technology was considered too great an investment for the Operator so the higher limit was agreed and applied. In addition, the Competent Authority commented that the previous limit for this point source was 150 mg/Nm^3 (as set out in GBR 833/1975) and the 80mg/m^3 limit (as included in the permit) was considered to provide a sufficient reduction in emissions. At the time of the site visit (October 2008), the cyclone was being repaired and particulate emissions of between 40-70 mg/Nm^3 could reportedly now be achieved. There are no further improvement conditions within the permit requiring the Operator to reduce particulate emissions from the cooler/dryer process. ELVs for NO_x (expressed as the sum of NO and NO_2, which must not exceed 100ppmv) are also just outside of the BAT-AEL range of 5-90ppmv. Also a high NO_x limit has been included for the Steam Boiler of 1,000 mg/Nm^{3,} based on the limits within the relevant GBR, which exceeds the BAT-AEL.
	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? The Competent Authority stated that relevant Environmental Quality Standards (EQSs) for Air and Water Quality were considered in the EIA and it was concluded that the installation does not cause pollution in the area and that there are no stricter limits that apply to the installation for the protection of this media. Monitoring data from the Air Quality Network was used in the EIA and according to the Competent Authority these results were considered when setting permit conditions. The EIA was not reviewed as part of this assessment and therefore conclusions could not be drawn on the results of the EIA and what was considered when undertaking the assessment. Further evidence that local conditions were considered is the requirement for the Operator to undertake an acoustic study as part of the IPPC application and inclusion of a permit conditions for the prevention of noise. It appears that the technical characteristics of the installation have been taken into account insofar as no ELVs have yet been set for N_2O emissions (as described in the section above). The relevant authorities were contacted to provide clarification on how technical characteristics, local factors and environmental conditions are considered at a site level when setting permit ELVs and, if the GBRs are used to directly set the ELVs, how are these environmental factors taken into account when developing or updating the GBRs. However, no information has been received on this issue.

	Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)? The Competent Authority commented that BAT could not be applied for the reduction of particulate emissions from the cooler/dryer process as the investment would have been too great for the Operator. A cost/benefit analysis undertaken by the Competent Authority indicated that even if the particulate abatement equipment were to be replaced, the reduction in emissions would not have been significant and that instead the whole equipment would need to be replaced to see any noticeable reduction, an option considered too costly for the Operator.
Use of relevant BREF documents in setting permit conditions?	There is no direct mention of the BREF document within the permit. The Competent Authority indicated that there is no national Spanish guidance, only a direct translation of the BREF for LVIC. The Competent Authority stated that the (translated) LVIC BREF and guidance provided by the Clean Technology Centre was considered when setting permit conditions. Where GBRs are applicable, they are clearly referenced within the permit.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains conditions on point source emissions for air, the parameters to be monitored and frequency of monitoring. Details of methods used and averaging periods have not been included. Annex III Section 10 of the permit contains conditions that require the Operator to submit the results of monitoring conducted to the Competent Authority. Specific dates have been given and reference is made to the relevant GBR on the obligation to supply information. **Are the monitoring requirements sufficiently detailed?** It is considered that the monitoring requirements are not sufficiently detailed. The permit does not contain details of methods used or averaging periods. This information was obtained from the Operator. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** The BREF document recommends monitoring the performance of the catalyst, used in the catalytic oxidation of ammonia, by monitoring N_2O emissions. In addition the BREF document describes BAT as the monitoring of key performance parameters and maintaining mass balances. However, there is no requirement in the permit to monitor N_2O emissions from the nitric acid manufacturing process. The Operator has a monitoring system in place for N_2O emissions. **Does the permit include information on duration in relation to monitoring requirements?** This information has not been included within the permit.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Yes, Annex III Section 6 of the permit specifies measures that must be adopted in abnormal situations to provide for protection of the environment.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes, where conditions are placed in the permit that refer to the requirements to comply with General Binding Rules, the GBR reference is clearly given on each condition.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The EIA undertaken as part of the IPPC application required an assessment of the emissions from the installation having regard to air quality standards. Based on the response from the Competent Authority, there are no relevant EQSs that require stricter conditions that those achievable through the use of BAT.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit contains information on the validity of the permit. The permit must be reviewed after 8 years of issue (2016) or before this time if there are substantial changes to activities at the installation. The Competent Authority can cancel the permit in the event of non-compliance.

Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The IPPC application and permit are available to the public on request to the competent authority. **Are monitoring records made available to the public?** Monitoring data is available to the public upon request. Annual emissions data for air, water and waste emissions is also made available on the EPRTR.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The Operator monitors for NO_X (sum of NO and NO_2), SO_2, CO, NH_3, particulates and opacity for emissions to air. The Operator also undertakes monitoring of noise levels and hazardous and non-hazardous waste quantities produced. Water emissions are regulated under a separate authorisation. Water emissions are monitored for BOD, COD, ammoniacal nitrogen, nitrates, total P,SO_4 pH, conductivity, suspended solids and oils and greases. Emission limits are set under a separate authorisation. Averaging periods are not specified in the permit, and the averaging periods given below to assess performance have been supplied by the Operator. The Operator indicated that the actual averaging periods applied and all monitoring meets the requirements of the permit. The Competent Authority did not provide any information on this, therefore this cannot be confirmed for this assessment.
Operator's compliance with monitoring conditions	Based on the responses of the Competent Authority and Operator during the interview, all requirements for monitoring are currently met by the Operator. However, as stated previously, this cannot be fully confirmed as there are insufficient monitoring details in the permit and the Competent Authority did not provide confirmation of the averaging periods that should be applied.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	Monitoring data has been provided by the Competent Authority, undertaken 19th – 30th January 2007 by the ECA (an external accredited organisation). All emissions were found to be within the emission limits that applied at that time prior to the IPPC permit limits. It is evident that the total emissions of NO_x (NO+NO_2) are similar or a little lower in the period October 2007-July 2008 than the period January 2007.
Current emissions of key pollutants	**This information is provided within the table below.** The results presented in the table below were provided by the Operator following the interview. Monitoring data for the period August and September 2008 has been obtained from the Operator (permit was issued in August). An average of the 2 months has been used in the performance table below. The Operator provided monitoring data for discharges to water. However as emissions to water are covered under a separate authorisation, only a summary can be provided of Operator performance. From the period January – September 2008, parameters are within ELVs set out in the permit, there were however some breaches of the ELVs for sulphates and ammoniacal nitrogen. Emission limits for releases to water are not included within the IPPC permit but will be in the future.

Assessment of Installation performance against BAT	Based on the monitoring data provided and discussions with the Operator and Competent Authority, the current emissions from the installation are all within permit ELVs, however both commented that some emissions have been very close to the limits, in particular particulate emissions from the cooler/dryer in the ammonium nitrate plant. Emissions are mostly within BAT-AELs, with the exception of particulates from the Cooler/Dryer (Ammonium Nitrate plant) and NO_x emissions from the steam boiler. Particulate emissions from the cooler/dryer were 50.17 mg/Nm^{3,} the BAT-AEL is 10-25 mg/Nm^3. A high ELV has been set for NO_x emissions from the steam boiler of 1000 mg/Nm^3 , the BAT-AEL is 5-90 mg/Nm^3 . Total NO_x emissions are within permit ELVs and BAT-AELs. The Operator has produced a report for the Competent Authority on the reduction of NO_x at the installation, which indicates that emissions of NO_x have been reduced. ELVs have not been included within the permit for emissions of N_2O and no further conditions have been identified that consider BAT for control of this pollutant. Justification for this was that limits have not been set for this pollutant for other facilities in the Member State and therefore, according to them (Competent Authority and Operator), these could not reasonably be included within this permit.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	Section 6 of the permit states that in the event of site closure, dismantling and closure will be undertaken in accordance with the relevant GBR, where land must be returned to the same condition as before the start of the activities on-site and no damage is caused to the soil and its environment. There is no specific requirement for the preparation of a site closure plan; however this may be included within the GBR.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The Competent Authority reviews monitoring data that is submitted in accordance with the timescale given in the permit. The Operator is required to produce an annual compliance report which details the emissions data for the previous year. An external accredited organisation undertakes compliance inspections in accordance with the GBR29/2007, the first inspection will normally be within 1 year of permit issue. The Operator must have implemented all permit conditions by this time. A report is sent to the Competent Authority and followed up if required. The Operator is also required to present a certificate to the Competent Authority that proves the installation and its activities are compliant with the permit. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** Sanctions or other measures have not been applied. The Competent Authority stated that the Operator is compliant; however, they have been close to the limits, in particular particulate emissions from the cooler/dryer. If the Operator is found not to be compliant with the conditions of the permit, the Operator is given time to implement the necessary corrective measures. If there is a more serious breach, an inspection will be carried out and the Competent Authority can stop operations at the installation. No such measures have been undertaken since the issue of the permit. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The Operator undertakes internal and external monitoring of emissions to ensure compliance with permit conditions. Annual emissions data reports are submitted to the Competent Authority. Each month a report is sent to the Competent Authority with the average NO_x emission values and its standard deviation. The Operator maintains what is referred to as 'An Official Book of Analysis' where all controls and analysis undertaken by the external organisation is recorded. This is available at any time for the Competent Authority to view. As part of the Environmental Management System (EMS), operating procedures are in place for compliance and there are procedures that must be followed in the event of non-compliance. The Operator intends to integrate the EMS with the IPPC permit conditions as part of planned improvements. The EMS is internally audited and once certification is achieved, it will also be externally audited. **Procedures used or action taken by the operator in the event of non-compliance** Any incident that occurs on-site that has the potential to cause non-compliance with the permit conditions is reported to the Competent Authority and a detailed report is presented within 7 days of the incident occurring. Under the EMS, if there is a non-compliance event, this would be recorded as a non-conformance and corrective and preventative action would be put in place.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** There has not been a site inspection within the last 12 months. A collaboration entity or accredited organisation undertakes compliance inspections in accordance with the GBR29/2007, the first inspection will normally be within 1 year of permit issue. The Competent Authority indicated that a site audit was due to be undertaken shortly after the site interview in October 2008. It is not known if this audit has been carried out since the interview. The permit requires that the Operator provide all the necessary assistance and co-operation during the site inspections. There are no planned audits for the installation. The Competent Authority stated that these would be undertaken if there were complaints or if there was a non-compliance event. They stated that they can undertake a visit at any time and carry out spot samples or request emissions data, but that normally site visits would be done if there are abnormal operating conditions at the site.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Monitoring data is available to the public upon request.

Key observations from this case study assessment
▪ Assessment of the technologies employed shows clear links to the information presented in the BREF that can be considered BAT for these processes and the Operator has shown commitment to increase environmental spend on priority areas such as improved catalyst for N_2O emissions abatement and other measures to prevent the formation of this gas. ▪ Where BAT technologies are not being employed, most notably the cooler/dryer process in the Ammonium Nitrate plant, emissions of particulates are shown to be very close to permit ELVs and above BAT-AELs ranges. ▪ From the assessment, it is apparent that the Competent Authority is setting ELVs and conditions based on the Operator's assessment and recommendations, without having undertaken an assessment of BAT themselves. The Operator has proposed limits that can feasibly be reached for particulates and NO_x emissions, and the Competent Authority has agreed these without providing justification for their decisions, either within the permit or as supporting documentation. ▪ It is clear that the majority of ELVs have been based on the GBR 127/2006. However, these are generic limits for industrial sectors and do not appear to take into account technical characteristics of the installation and local environmental factors. The relevant authorities were contacted to provide clarification on how technical characteristics, local factors and environmental conditions are considered at a site level when setting permit ELVs and, if the GBRs are used to directly set the ELVs, how are these environmental factors taken into account when developing or updating the GBRs. However, a response on this issue has not been received. There is evidence however that local factors were considered in setting some permit condition, specifically for noise emissions monitoring. ▪ An ELV for N_2O emissions has not been included within the permit and no further conditions for the reduction of this greenhouse gas have been included. According to the Operator, the reason for this is because national legislation does not contain limits for N_2O emissions. ▪ There are no ELVs for NH_3 emissions from the Nitric Acid plant stack, although the Operator has continuous monitoring in place for this pollutant. ▪ Information on monitoring requirements in the permit is insufficient. Averaging periods have not been provided in the permit. ▪ There are no conditions on the efficient use of energy; however based on the information provided by the Operator, it is evident that there are significant energy efficiency measures in place and there is limited scope for improvement in this area.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Steam Boiler	Opacity	<1	2	No BAT-AEL in BREF	Yes	No BAT-AEL in BREF	Bacharach scale method	Annually	101.3 kPa, 273.16 °K, 15%O_2
	SO_2	9 mg/Nm^3	200mg/Nm^3	No BAT-AEL in BREF	Yes	No BAT-AEL in BREF	ECA Laboratory method	Annually	101.3 kPa, 273.16 °K, 15%O_2
	CO	6 mg/Nm^3	625mg/Nm^3	No BAT-AEL in BREF	Yes	No BAT-AEL in BREF	ECA Laboratory method	Annually	101.3 kPa, 273.16 °K, 15%O_2
	NO_x (expressed as NO_2)	107 mg/Nm^3	1,000mg/Nm^3	5-90ppmv	Yes	No	ECA Laboratory method	Annually	101.3 kPa, 273.16 °K, 15%O_2
Absorption Tower (Nitric Acid production plant)	NO_x (expressed as NO)	25mg/Nm^3	66.97 mg/Nm^3 (50ppmv NO)	5-90ppmv	Yes	Yes	TESTO analyser	Internal auto control every 15 days. Once per year by ECA Lab. methods	101.3 kPa, 273.16 °K, 15%O_2
	NO_x (expressed as NO_2)	67 mg/Nm^3	102.68 mg/Nm^3 (50ppmv NO_2)		Yes	Yes	TESTO analyser		101.3 kPa, 273.16 °K, 15%O_2
	Opacity	No data	2	No BAT-AEL in BREF	No data	No data	Bacharach scale method		101.3 kPa, 273.16 °K, 15%O_2
	Particulates	No data	30	No BAT-AEL in BREF	No data	No data	See note 3	Not given	101.3 kPa, 273.16 °K, 15%O_2

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Cooler- Dryer Chimney (AN production - granulation plant)	Particulates	50.17 mg/Nm^3	80 mg/Nm^3	10-25mg/Nm^3	Yes	No	Isokinetic stack sampling system (TCR Tecora) Gravimetric	Biweekly and monthly	101.3 kPa, 273.16 °K, 15%O_2
Limestone mill & Line A & B Dust capture in packaging building	Particulates	4.8 mg/Nm^3 (limestone mill) <3 mg/Nm^3 (Line A & Line B)	30mg/Nm^3	No BAT-AEL in BREF	Yes	No BAT-AEL in BREF	Isokinetic stack sampling system(TCR Tecora) Gravimetric	Annually	101.3 kPa, 273.16 °K, 15%O_2

Notes: No emission limit values have been set for N_2O emissions as described elsewhere in this section.

Averaging periods were provided by the Operator. It cannot be confirmed if these meet the requirements of the permit, as the permit does not specify what the averaging periods should be. No averaging periods are specified in the BREF.

Emissions to water

ELVs for emissions to water (sea) have not been included within the permit. Emissions to water were regulated under a separate authorisation and by a separate authority (Conselleria of Public Works, Urbanism, Transport) and the discharge conditions within this authorisation still apply, until the expiration of the authorisation (on 23/11/ 2012) or until the Competent Authority make a decision on whether the conditions are appropriate.

3.5.7 Nitric acid manufacture – summary

Based on the preceding three case studies (installations in Italy, Netherlands and Spain), the following main conclusions can be drawn (in addition to the quantitative conclusions drawn in Section 5 and Appendix H):

- Despite the importance of nitrous oxide emissions highlighted in the relevant BREF, ELVs are not included in the permits for nitrous oxide for two of the three installations; Spain and Italy. The reason provided for such an exclusion in Spain was indicated to be a result of national legislation that does not contain ELVs for this pollutant (according to the operator). In the Italian case, the reason provided by the competent authority was that emissions from the nitric acid process were understood to be relatively low (however, there is a pilot plant in place for catalytic destruction of N_2O from the associated adipic acid process, which generates a significantly higher quantity of N_2O emissions).

- For the third installation (Netherlands), the permit ELV for nitrous oxide (300 ppmv) is at the upper end of the BAT-AEL range (20-300 ppmv). Reported emissions from this installation were below the permit ELV.

- In relation to NO_x emissions, all three of the permits contain ELVs; these range from around 40 ppmv (Netherlands) to around 220 ppmv (Italy) (the value for the Spanish installation is 50 ppmv). Emissions of NO_x from the nitric acid processes range from 28 ppmv (Netherlands) to 147 ppmv (Italy). The BREF BAT-AEL is 5-90 ppmv.

- The monitoring undertaken for the installations was generally reported as being compliant with the permit conditions, although data availability for one installation did not allow this aspect to be confirmed.

- All of the installations were inspected by the competent authority, with inspection frequencies ranging from less than one per year to more than four per year.

The table below provides an indicative summary of the standards and emissions to air of key pollutants from this sector. In particular, it includes information on the relevant BREF BAT-AELs; ELVs set in permit conditions; and actual installation performance. This information is only intended to be indicative of the broad ranges of these values and the reader is referred to the assessments for each installation for further information on the emissions from specific sources and the applicable permit ELVs and BAT-AELs.

Table 3.10 Indicative information on emissions of certain air pollutants from nitric acid manufacture installations (BAT-AELs, permit ELVs and actual installation performance)

Member State	Pollutant	BAT-AEL (Note 1)	Permit ELVs (Note 1)	Actual emissions (Note 1)
Italy	N_2O	20-300 ppm	None	No data
Netherlands	N_2O	20-300 ppm	1000 ppm maximum 300 ppm average over lifetime of catalyst	216 ppm (30 min averages)
Spain	N_2O	20-300 ppm	None	No data
Italy	NO_x	5-90 ppm	195-219 ppm (30 min averages)	57-147 ppm (30 min averages)
Netherlands	NO_x	5-90 ppm	40 ppm	28 ppm (30 min averages)
Spain	NO_x	5-90 ppm	50 ppm (annual average)	67 mg/m^3 (32 ppm) (annual average)
Italy	NH_3 slip from SCR	<5 ppm	22 ppm (30 min averages)	0.2 ppm (30 min averages)
Netherlands	NH_3 slip from SCR	<5 ppm	<5 ppm	No data
Spain	NH_3 slip from SCR	<5 ppm	None	No data

Notes:

1) Where there are several points at which emissions are measured and ELVs set, the range is quoted. Note that the LVIC-AAF BREF does not specify the averaging periods to be used.

3.6 Fertiliser manufacture (NPK/CN)

3.6.1 Sector background

The production of compound fertilisers using the key components of nitrogen, potassium and phosphorous (NPK) involves a number of complex manufacturing process stages and may be achieved using a mixed acid process (with or without phosphate rock digestion), nitrophosphate process or mechanical grinding and blending of single or multi-nutrient compounds.

As set out in the LVIC BREF, demand for NPK fertilisers in various compositions results in two plant types: production by the mixed acid route and production by the nitrophosphate route. Although the latter requires higher investment and integration with other fertiliser production, it offers the option to increase the P component in the product without using phosphoric acid.

The plant size varies from several hundred to up to more than 3,000 tonnes per day. A plant of typical size produces about 50 tonnes per hour (1,200 tonnes per day or 350,000 tonnes per year). As of February 2006, there were 38 NPK fertiliser producers in the EU-25 that had a capacity of more than 150,000 tonnes per year.

3.6.2 Key environmental issues and BAT

The most important emissions to air from fertiliser manufacture are NH_3, NO_x, HF, HCl and dust. The main source of NO_x is the dissolution of phosphate rock in nitric acid. The main source of NH_3 is from the neutralisation process (pipe reactor, pre-neutralisation tank, granulation drum ammoniation or ammoniation tanks). Fluorine compounds originate from the phosphate rock. The main sources of fertiliser dust are the drying and granulation drums, spherodiser and/or prilling towers, with dust also coming from the cooling drum, screens, crushers and conveyors.

Table 3.18 Raw materials and key environmental issues

Raw Material	Production of	Key Environmental Issues
Phosphate rock, SSP/TSP NH_3 H_2SO_4, H_3PO_4, HNO_3 Various other	NPK*	Air: NH_3, NO_x, HF, HCl, dust Waste water

* Raw materials and emissions depend on the particular NPK ratio compound produced.

Table 3.19 Generic and Process-Specific BAT techniques from the BREF on Large Volume Inorganic Chemicals

Element	BAT
Generic BAT	Implement and adhere to an Environmental Management System (EMS) that incorporates, as appropriate to individual circumstances, the features as defined within Chapter 1.5.2 of the LVIC BREF document (pp. 34); Carry out regular energy audits for the whole production site; monitor key performance parameters; establish and maintain mass balances for: ▪ nitrogen ▪ P_2O_5 ▪ steam ▪ water ▪ CO_2. Minimise energy losses by: ▪ generally, avoiding steam pressure reduction without using the energy ▪ adjusting the whole steam system in order to minimise excess steam generation ▪ using excess thermal energy on-site or off-site or as a last option, using steam for generating only electrical power, if local factors prevent the use of the excess thermal energy on-site or off-site. Improve the environmental performance of the production site by a combination of the following techniques: ▪ recycling or re-routing mass streams ▪ efficiently sharing equipment ▪ increasing heat integration ▪ preheating of combustion air ▪ maintaining heat exchanger efficiency

Element	BAT
	▪ reducing waste water volumes and loads by recycling condensates, process and scrubbing waters ▪ applying advanced process control systems ▪ maintenance
NPK-Specific BAT	Improve environmental performance of the finishing section through use of: ▪ Plate bank product cooling ▪ Recycling of warm air ▪ Selecting proper size of screens and mills (e.g. roller or chain mills) ▪ Applying surge hoppers for granulation recycle control ▪ Applying online product size distribution measurement for granulation recycle control Reduce dust emissions from rock grinding, e.g. by application of fabric filters or ceramic filters and to achieve dust emission levels of 2.5 – 10 mg/Nm^3. Prevent dispersion of phosphate rock dust by using covered conveyor belts, indoor storage, and frequently cleaning/sweeping the plant grounds and the quay. Minimise NO_x load in exhaust gases from phosphate rock digestion through use of ▪ Accurate temperature control ▪ Proper rock/acid ratio ▪ Phosphate rock selection ▪ Controlling other relevant process parameters Apply multi-stage scrubbing to reduce emissions to air from phosphate rock digestion, sand washing and CNTH filtration and achieve BAT-AELs presented in the table in the next section. Apply dust removal technologies such as cyclones and/or fabric filters and/or wet scrubbing (e.g. combined scrubbing) to achieve emission levels the table in the next section. Minimise wastewater volumes by recycling washing and rinsing waters and scrubbing liquors into the process e.g. using residual heat for wastewater evaporation ensuring adequate treatment of the remaining wastewater volumes.

3.6.3 Main emissions and levels associated with BAT

The main emissions and levels associated with BAT have been taken from the BREF on Large Volume Inorganic Chemicals (August 2007). BAT-AELs for emissions to air are summarised in the table below.

The BREF indicates that waste water that cannot be avoided is discharged after adequate treatment, e.g. biological waste water treatment with nitrification/denitrification and precipitation of phosphorous compounds. No BAT-AELs are included in the BREF for emissions to water.

Table 3.20 BAT Associated Emission Levels (AELs) for air from NPK processes

	Parameter	BAT-AEL (mg/Nm^3) (Note 1)	Removal efficiency (%)
Phosphate rock digestion, sand washing, CNTH filtration	NO_X as O_2	100 – 425	
	Fluoride as HF	0.3 – 5	
Neutralisation, granulation, drying, coating, cooling	NH_3	5 – 30 (Note 2)	
	Fluoride as HF	1 – 5 (Note 3)	
	Dust	10 - 25	>80
	HCl	4 - 23	

Notes:

1) No averaging periods are specified in the BREF on Large Volume Inorganic Chemicals.

2) The lower part of the range is achieved with nitric acid as the scrubbing medium. The upper part of the range is achieved with other acids as the scrubbing medium. Depending on the actual NPK grade produced (e.g. DAP), even by applying multistage scrubbing, higher level emission levels might be expected

3) In the case of DAP production with multistage scrubbing with H_3PO_4 levels of up to $10mg/Nm^3$ might be expected.

3.6.4 Case study 1 – Italy

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/IT/23. The information in this table is based on the detailed assessment for this installation in Appendix E1. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is a listed activity as defined within Annex 1, Section 4.3 *"Chemical installations for the production of phosphorous-, nitrogen- or potassium-based fertilizers (simple or compound fertilizers)"*. The installation, established in 1966, produces approximately 25,000 tonnes per year of NPK fertilisers for use in agricultural purposes. The main activities at the site include: ▪ Blending ▪ Granulation ▪ Drying ▪ Sieving ▪ Roller crusher ▪ Bagging/palletisation Within the installation, hazardous liquid substances are stored in suitable closed containers and loose raw material in suitable storage areas. In addition all plant involved in the product cycle is inspected and maintained. These steps help to minimise fugitive emissions. A cyclone and scrubber abate emissions from the granulation and drying operations, reducing emissions of dust and ammonia to atmosphere. A predetermined amount of the first run-off water is captured by a drain network and sent to a sedimentation tank for separation of suspended solid. After the solids have settled, the water is sent to a

	storage tank from where the water is sent to the pelletisation process as process water. This reduces the use of well water in the process. The installation has implemented an environmental management system that meets the requirements of ISO14001.
Type of permit / issue date	This was a new permit for an existing installation. Previously the installation had been regulated separately for emissions to air and to water under separate, pre-existing regulatory regimes. The permit was issued by the competent authority before the end of October 2007 (precise timescales are considered confidential).
Basis of BAT determination	The BREF document for *Large Volume Inorganic Chemicals – Ammonia, Acids & Fertilisers* was used by the operator for the determination of BAT. In relation to emissions to water, ELVs are set out in national legislation and as such constitute GBRs.
Permit application	
Requirements of Article 6	The operator used the electronic template provided by the regional authority to make their application. This template had been developed to take into consideration all Article 6 requirements. However, it was found that the information provided by the operator within the initial application was insufficient. The operator was consequently required to provide the competent authority with further information in relation to the application of BAT within the installation. This absence of information was addressed through the issue of a formal request for further information. This subsequent information on BAT, provided by the operator was considered by the competent authority in determining the permit.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit starts with a detailed summary of the information provided by the operator within the application. This includes a description of location, plant, emission sources, waste production, land remediation and risk of major accident. This is followed by an assessment of the application of BAT, as provided by the operator. Conditions are included in the permit that address the requirements of Article 3, including pollution prevention, waste avoidance, recovery and disposal, energy efficiency, accident prevention and site closure.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** Within section E.1 of the permit, a table summarises the ELVs that have been set for the four emission points associated with the granulation, screening, bagging and local exhaust ventilation emission points. **Water:** While no specific ELVs are included within the permit for emissions to water, reference is made to the need to comply with the ELVs documented within national legislation D. Legs 152/06 Table 3, Appendix 5 which relate to the discharge to watercourses. **Land:** No ELVs have been set for emissions to land. **Protection of soil and groundwater** Prescriptive requirements in relation to land and protection of soil are included n the permit. Specifically these requirements include the following: • Drainage grids and hardstanding areas are to be kept clean and in a state of good repair. • Loading and unloading of material is to be carried out with utmost attention to ensure that nothing permeates the ground. • Any spillage (including accidents) is to be contained and recovered with a dry technique, as far as possible. • Management of above ground tanks, below ground tanks and associated pipework is to be in line with national legislation. **Waste** Prescriptive requirements in relation to waste are included in the permit. Specifically these requirements include the following:

	• Specific storage and disposal requirements regarding waste batteries, vehicles and oil, including from transformers. • Waste storage areas are to be protected from rainwater. A suitable system is to be put in place for treated rainwater contaminated with waste. • Waste is to be stored in line with national legislation. • Details of the measures to be taken during storage and transportation of waste on the site to ensure that pollution does not occur (specific detail is given for the storage of waste in drums and tanks). **Transboundary considerations** Due to the distance of the installation from the nearest country boundary and the small scale of the installation activities, transboundary pollution has not been taken into consideration in this permit. **Further equivalent technical parameters/measures** The permit sets out limits in relation to noise and with reference to local zoning requirements as defined within regional legislation, specifically: • Absolute limits relative to the 100m band (zone) – 65dB(A) for day; 55dB(A) for night • Outside 100m – 60dB(A) for day; 50dB(A) for night.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** ELVs set appear to be in line with BAT-AELs with the exception of the ELV for HCl, which is slightly higher than the BAT-AEL defined within the BREF document. The competent authority has assessed the application of BAT in other areas and has highlighted, within the permit, that certain operational aspects are not representative of BAT, which include: ▪ Dust emissions from the granulation process are higher than BAT-AELs, due to the absence of suitable abatement on the granulation process. ▪ The current conveying system for the storage and feed hopper loading of both raw material and loose final product generates emissions of diffused dust in the workplace. Where BAT has not been met, the operator has in some instances incorporated these requirements into an improvement programme. This improvement programme, proposed by the operator is included within the permit and specifically includes the following: ▪ Requirement for the installation of a bag filter and bigger fan on emission point E1 with the aim of reducing emissions of dust to air, within 3 months of permit issue. ▪ Requirement to install a conveyor belt with a system for monitoring the quantity of material exiting the sieving plant connected to the dryer for mass balance calculations, within 6 months of permit issue. ▪ Requirement for new plant for collecting dust within the production area with the aim of reducing diffuse dust in the workplace, within 6 months of permit issue In addition to this the permit includes a section entitled 'Application of IPPC and Related Timescales' which outlines the improvements required by the competent authority. This section outlines improvements which are to be implemented at the site under the conditions in the permit to ensure application of BAT. Further detail can be found in Q6 of the full assessment report in Appendix E1. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** There is no evidence of consideration of specific technical characteristics, geographic location or local environmental conditions influencing the setting of emission limit values. **Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?** None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** None observed.

Use of relevant BREF documents in setting permit conditions?	The competent authority has made direct reference to the BREF document on "Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers" and has assessed installation performance against BAT as defined within this document. This assessment forms part of the Decision Document produced when developing the permit.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Section F of the permit details the monitoring requirements. Reference is clearly made within this section to the parameters to be measured, frequency of control and measurement methodology for each emission point to air and to water. In addition, this section of the permit sets out requirements to monitor water and energy consumption, waste production, noise and process parameters. **Are the monitoring requirements sufficiently detailed?** The monitoring requirements within the permit are sufficiently detailed for the operator, with regards to information on parameters, frequency and method. However there is no information provided in the permit relating to sampling/measurement time. **Do the monitoring requirements take into account the details contained within the BREF documents?** The BREF document for Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers defines BAT as the carrying out of regular energy audits for the whole production site, to monitor key performance parameters and to establish and to maintain mass balance for nitrogen, P_20_5, steam, water and CO_2. The permit sets out in a monitoring plan a requirement for the operator to monitor key performance indicators (m^3 water/year, KWh/year, KWh/tonne of product, etc.). In relation to water, the permit requires the operator to provide information on the percentage of water re-circulated in the process. In addition, the monitoring plan sets out requirements for the annual monitoring of the quantities of all raw materials, final product and semi-finished product re-circulated to production lines. No specific mention is made in the permit to the conducting of mass balances. **Does the permit include information on duration in relation to monitoring requirements?** The permit does include information on duration. .As indicated above, it does not include information on sampling/measurement time.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Within Section E.6 of the permit there are specific requirements relating to the need for the operator to remain within the ELVs during start up, shut down and any plant malfunctions. The permit indicates that this may be achieved through the slow down of production, or if necessary through the shut down of the plant. In the case of malfunction of the abatement plant, the operator is required to shut down the process within 60 minutes.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** The ELVs for discharges to water from this installation are based on national legislation. Reference to this legislation is made within the permit.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The competent authority reported that there were no community or national EQSs that required stricter conditions than those achievable through the application of BAT or compliance with national legislation.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	As documented within the permit and as defined with national legislation, the permit is valid for a 5 year period. At this time the operator will be required to submit an application for the permit to be reissued. As the permit was only issued in October 2007 (amended in December 2007) it will not require reconsideration until December 2012.

Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Following submission of the permit application, an advertisement was placed in the local newspaper to notify the public of the presence of the application and giving a period of 30 days in which this could be reviewed and commented on. No comments were received from the public during this period. Information relating to the application, permit and any associated IPPC documentation would be made available to the public on request. **Are monitoring records made available to the public?** Information on monitoring is made available to the public on request.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	Annual monitoring of emission points E1 and E2 is carried out by external consultants. In addition, the Operator collates monthly data relating to energy, water and fuel use.
Operator's compliance with monitoring conditions	The permit sets out requirements for monitoring of four emission points to air. As described above, monitoring has been conducted on emission points E1 and E2. Emission point E4 relates to a future emission point associated with a proposed local exhaust ventilation (LEV) system. There is no dust monitoring data currently available for emission point E3 (bagging). The permit also sets out requirements for monitoring on two water emission points, S1 (first rainwater discharge) and S2 (clean rainwater discharge), which both discharge to a watercourse. The operator is currently not in compliance with this requirement and has not currently conducted monitoring in relation to these emission points. The permit specifies that the operator is required to carry out monitoring as detailed within the permit, following implementation of all improvement conditions. Until this point the permit specifies the need to refer to the old monitoring regime.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	The application showed that, in the absence of suitable abatement equipment, the emissions of NOx and particulates from the drying and granulation process (E1) were high and exceeded the BAT AELs ($75 mg/m^3$ for dust and $250 mg/m^3$ for NO_x.).
Current emissions of key pollutants	Monitoring data made available by the operator suggests that the ELVs (and subsequently the BAT-AELs) are currently being met for all pollutants, including HCl. This information is provided within the table below for air emissions. No data were made available on emissions to water.
Assessment of Installation performance against BAT	**Current performance:** Based on a BAT assessment conducted by the operator, the competent authority reported within the permit that the emissions from the granulation and drying operations (emission point E1) for dust and ammonia were in excess of the BAT-AELs since no abatement was in place. As a result, an improvement programme was included within the permit requiring new abatement equipment. The new abatement equipment is now in place and this has significantly reduced the emissions. The table below shows that the installation is compliant with the limits set within the permit for emission points E1 and E2. As indicated above, no monitoring data is currently available for air emission points E3 and E4, and water emission points S1 and S2.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The operator did not submit any information relating to site closure as part of the application. The permit does not require any decommissioning or site closure plans. However it does set out requirements for the risk of pollution to be avoided at cessation of activities and for the operator to return the site to its original state in line with national legislation requirements.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** As a requirement of IPPC, the operator submits an annual monitoring report. A copy of this monitoring report is required, as documented within the permit, to be sent to the competent authority, Commune (town council) and ARPA (regional agency for environmental protection). A review of this information will be undertaken as a preliminary compliance check. ARPA will conduct an annual site inspection as a requirement of IPPC. In addition they will conduct inspections specifically in relation to emissions to air (annually) and emissions to water (6 monthly). The site inspection may include spot sampling. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** No. If an ELV is exceeded, the operator would be issued with a fine and if necessary a formal request to implement measures to reduce the emissions to set timescales. In the event of action not being taken by the operator then a criminal prosecution may be pursued. If a monitoring report is not submitted in time by the operator then a formal notice would be issued by the competent authority requesting this information. If no action is then taken by the operator then this may result in prosecution. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The following approaches are taken by the operator to ensure compliance: ▪ Monitoring of point source emissions by external contractors on an annual basis. ▪ A supervisor, with knowledge and understanding of IPPC, oversees process operations and takes action to address any operational issues which may impact on compliance. ▪ Monthly checks are done on energy, fuel and water use, relative to tonnage of material produced. ▪ The temperature of the dryer is monitored and recorded on a continuous basis to ensure that it remains within a certain range, as variation outside of this range could impact on emissions. **Procedures used or action taken by the operator in the event of non-compliance** In the event of a major problem, which could result in a significant environmental impact, the plant would be shut down. The Managing Director would notify the Competent Authority (the agreement with the Competent Authority is for an "immediate" notification that is as soon as is safe to do so).
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The permit sets out requirements for ARPA to carry out two standard controls (visits) to the installation during the 5 year validity of the permit. One of these visits is to take place 6 months after implementation of all improvements at the installation. The indication of at least two inspections during the permit validity period derives from guidelines issued jointly by the Ministries of Environment, Public Health and Economic Development (Linee Guida per i Piani di Monitoraggio di Impianti IPPC, 31 Jan 2005). In addition, it is reported that ARPA would conduct visits specifically in relation to emissions to air and water (as described above). They may conduct further visits throughout the year as required.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Results of monitoring are available upon request.

Key observations from this case study assessment

- The majority of the ELVs within the permit have been set in line with the BAT-AELs, with the exception of emissions to air of HCl.
- Monitoring data made available by the operator suggests that the ELVs (and subsequently the BAT-AELs) are currently being met for all pollutants, including HCl.
- Historically, emissions of dust and ammonia have been higher than BAT-AELs. As a result, an improvement programme was included within the permit requiring the installation and operation of new abatement equipment. This equipment is now in place and has significantly

reduced the emissions, to within the BAT-AEL ranges for both pollutants.

- At present, monitoring is not conducted as detailed within the permit because the permit sets out requirements for the monitoring programme to commence once all improvement conditions have been completed. At the time of the site visit, the operator had not completed the improvement programme conditions within the set timescales due to issues of lack of available resource and a need to wait until scheduled plant shut down.
- For the monitoring data that has been available, the installation is compliant with the limits set within the permit for emission points E1 and E2. No monitoring data is currently available for air emission points E3 and E4, nor for water emission points S1 and S2.
- Energy efficiency and site closure do not appear to be sufficiently addressed within the application or the subsequent determination or the permit.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
E1 (Granulation & drying)	Total dust	1.2 - 2.4	20	10-25	Yes	Yes	UNI EN 13284-1	(See notes)	273.15K, 101.323kPa
	NH_3	23.9-26.2	30	5-30	Yes	Yes	M.U. 632 Man.122	-	273.15K, 101.323kPa
	NMVOC	4.0-4.3	20	N/A	Yes	N/A	UNI EN 12619	-	273.15K, 101.323kPa
	NOx (as NO_2)	19.0-21.6	250	N/A	Yes	N/A	UBI EN 10878	-	273.15K, 101.323kPa
	SOx	0.3-0.40	500	N/A	Yes	N/A	UNI EN 10393	-	273.15K, 101.323kPa
	Sulphuric acid	6.1-9.0	50	N/A	Yes	N/A		-	273.15K, 101.323kPa
	HCl	0.40 - 0.50	30	4-23	Yes	Yes	UNI EN 1911	-	273.15K, 101.323kPa
	Hg	<0.01	0.2	N/A	Yes	N/A	UNI EN 13211	-	273.15K, 101.323kPa
	Cr(vi)	<0.01	1	N/A	Yes	N/A	UNI EN 14385	-	273.15K, 101.323kPa
E2 (Screening)	Total dust	6.1	20	10-25	Yes	Yes	UNI EN 13284-1	-	273.15K, 101.323kPa
	NH_3	18.7	30	5-30	Yes	Yes	M.U.632 Man.122	-	273.15K, 101.323kPa
	NMVOC	0.2	20	N/A	Yes	N/A	UNI En 12619	-	273.15K, 101.323kPa
	NOx	7.8	250	100-425	Yes	Yes	UBI EN 10878	-	273.15K, 101.323kPa
	SOx	<0.1	500	N/A	Yes	N/A	UNI EN 10393	-	273.15K, 101.323kPa

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	Sulphuric acid	2.1	50	N/A	Yes	N/A		-	273.15K, 101.323kPa
	HCl	0.40	30	4-23	Yes	Yes	UNI EN 1911	-	273.15K, 101.323kPa
	Hg	<0.01	0.2	N/A	Yes	N/A	UNI EN 13211	-	273.15K, 101.323kPa
	Cr (VI)	<0.01	1	N/A	Yes	N/A	UNI EN 14385	-	273.15K, 101.323kPa
E3 (Bagging)	Total dust	N/A	10				UNI EN 13284-1	-	273.15K, 101.323kPa
E4 (LEV)	Total dust	N/A	10				UNI EN 13284-1	-	273.15K, 101.323kPa
Notes: Cells where a dash "-" is included indicate that no information is available on this aspect. No information on the averaging periods specified for the permit ELVs has been identified; similarly the LVIC BREF does not specify an averaging period for the BAT-AELs.									
Emissions to water									
S1 and S2	Volume			N/A	-	-			
	pH	-	5.5-9.5	N/A	-	-	IRSA 2060	-	-
	Gross materials	-		N/A	-	-	IRSA 2090	-	-
	Total suspended solids	-	≤ 80 mg/l	N/A	-	-	IRSA 2090	-	-
	Mercury	-	≤ 0.005 mg/l	N/A	-	-	IRSA 3200	-	-
	Sulphate	-	≤ 1000 mg/l	N/A	-	-	IRSA 4020	-	-
	Chloride	-	≤ 1200 mg/l	N/A	-	-	IRSA 4020	-	-

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	Total P	-	≤ 10 mg/l	N/A	-	-	IRSA 4020	-	-
	NH_4	-	≤ 15 mg/l	N/A	-	-	IRSA 4030	-	-
	Nitrous acid	-	≤ 0.6 mg/l	N/A	-	-	IRSA 4050	-	-
	Nitric acid	-	≤ 20 mg/l	N/A	-	-	IRSA 1020	-	-
	Potassium	-		N/A	-	-	IRSA 3240	-	-

Notes: Cells where a dash “-“ is included indicate that no information is available on this aspect.
No monitoring data were made available.

Emissions to land
Notes: Not applicable.

3.6.5 Case study 2 – Netherlands

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/NL/24. The information in this table is based on the detailed assessment for this installation in Appendix E2. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation produces NPK fertilisers, with a production capacity of 700,000 tonnes per year and also undertakes trading of several related products (produced by the parent company) for the European market. Processes which are carried out on site are: • (Un)loading of raw materials (liquid and solid); • Production and loading of fertilisers; • Storage and (un)loading of raw materials and products (parent company); • Supporting facilities: technical service, laboratory. A wide range of measures are included within the permit relating to pollution prevention related, for example, to storage, prevention of dust emissions, reducing noise, general measures to reduce water pollution, spill controls, waste (avoidance, recovery, re-use), energy efficiency and site closure measures. In relation to air emissions, for example, the installation uses fabric filters, closed conveyors amongst other measures.
Type of permit / issue date	The permit application was submitted on 29 August 2003 in order to obtain a revised permit for the site. The application was made as a consequence of a substantial change in the production process. The revised permit was issued on 12 December 2003. On 26 October 2005, a change in permit conditions was initiated by the authorities, in order to enforce an alternative method of measuring the emissions from the dryer. On 6 March 2008, another change in permit conditions was enforced in order to adapt the permit conditions in accordance with BAT for the storage of dangerous substances and the ELVs for dust.
Basis of BAT determination	It is not clearly stated in the permit which sources are used for the determination of BAT. The company was invited by the authorities in 2003 to perform a BAT-check. Use of BAT was assessed in several phases, based on when the relevant BREF documents were made available. Because the final version of the BREF-document for fertilisers was published only recently (LVIC BREF, August 2007), the BAT check was finalised on 6 September 2007 and approved on 11 October 2007 by the CA and later on (30 August 2008) also approved by the CA responsible for waste water discharge.
Permit application	
Requirements of Article 6	The application did not meet the all of Article 6 requirements (information was missing on e.g. condition of the site, proposed technology and other techniques for reducing or preventing emissions from the Installation, measures for prevention and recovery of waste and others). There has been no request from the CA to submit additional information.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** All items of Article 3 of the Directive are covered in the permit: pollution prevention measures, measures to make sure that no significant pollution is caused, waste avoidance, recovery and disposal measures, energy efficiency measures and site closure measures.

Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	ELVs for emissions to air are set in the permit mostly based on GBRs for key pollutants (dust, NOx, HF). ELVs for discharges to water are set in a separate permit. Issues of soil protection and noise emissions are also governed by GBR.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** For the main emission sources, the ELVs appear to be in line with BAT-AELs. However, it is not clear from the permit or the application how BAT has been taken into account. Generally in the Netherlands, the ELVs set are the most stringent of BAT and GBRs, where, besides BAT, other regulations (e.g. the NEC Directive) and experience of the CA and within the sector are also taken into account. A suggestion was made during the assessment that, for defining the performance level of BAT, preference should be given to throughput-related targets. e.g. kg pollutant / tonne of fertiliser. This is possible for mature and/or relatively uniform sectors. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** No **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** No
Use of relevant BREF documents in setting permit conditions?	There is no direct mention of the BREF document within the permit so it is not clear whether or how the BREFs have been taken into account. The company was invited by the authorities in 2003 to perform a BAT-check. Use of BAT was assessed in several phases, based on when the relevant BREF documents were made available. Because the final version of the BREF-document for Fertilisers was published only recently (LVIC BREF, August 2007), the BAT check was finalised on 6 September 2007 and approved on 11 October 2007 by the CA and later on (30 August 2008) also approved by the CA responsible for waste water discharge.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The monitoring requirements are not detailed in the permit or the application, but the permit refers to GBRs (such as the Netherlands Emission Guidelines for Air, NeR). The GBRs have not been assessed in detail for this study. However, they include details of a range of standard methods; frequency (as determined by 'Emission Relevant Parameters'; verification methods; etc. The NeR is available on the internet (www.infomil.nl) **Are the monitoring requirements sufficiently detailed?** The GBRs (NeR) provide detail on the requirements of Article 9(5). There appears to be sufficient detail in these GBRs to determine how these should be applied **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** The GBRs state that "For activities that fall under a BREF, the BREF describes the Best Available Techniques, and measures must be imposed in conformance with the BREF **Does the permit include information on duration in relation to monitoring requirements?** This information is set out in the relevant GBRs (NeR)
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	There are no measures relating to conditions other than normal operation.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes, ELVs for discharges to air are mostly based on GBRs, the Dutch emission guideline for air emissions (NeR). The BREFs and BAT have been taken into account when writing the NeR, as is experience from industry and competent authorities. ELVs for air emissions are included directly within the permit (concentration-based limits and mass emissions per hour are included).

Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** No
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit conditions are reconsidered frequently. Such a reconsideration of permit conditions was initiated by the competent authorities in 2005 and 2008. There is no expiry date specified in the permit.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The application and the permit were made available on a public register for a period of 1.5 months after the date of issuing of the permit. The permit itself is publicly available upon request. **Are monitoring records made available to the public?** Monitoring records are retained and available to the public in the annual environmental report produced by the operator. The yearly loads to air and water of large installations such as this are publicly available on the internet (emissieregistratie.nl).

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	Emission sources to air are sampled and analysed once a year. Emissions to water are sampled and analysed once a week.
Operator's compliance with monitoring conditions	Monitoring is understood to be compliant with the GBRs.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	No data were made available.
Current emissions of key pollutants	This information is provided within the table below.
Assessment of Installation performance against BAT	Based on the provided monitoring records, the installation performance is in line with the permit ELVs and emissions are below the upper end of the BAT-AELs (however, data were not available for all emissions points).
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	These measures are governed by GBR. As the land is owned by a third party, there is a contractual clause that the site has to be returned into a satisfactory state for new developments after cessation of the activities.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** Regular inspections **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** To date, a formal enforcement letter has always been sufficient to deal with the minor non-conformities detected. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** • Inspection rounds using a checklist with relevant issues to check • Daily inspection rounds by the environmental coordinator • Internal audits (integrated ISO management system complying with ISO14001) **Procedures used or action taken by the operator in the event of non-compliance** The operator aims to solve the non-compliance as soon as possible and communicates with the authority about the actions taken.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** There are 15 inspections each year. It is unclear how the frequency of inspections has been determined.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Monitoring records are made available to the public in the annual environmental report.

Key observations from this case study assessment
The company did not perform a BAT assessment as a part of a permit application, but conducted a separate evaluation on the invitation of and in close co-operation with the CA. The latter was finished only very recently prior to the site visit because the BREF document for fertilisers (LVIC) was also published only recently. As a result of this BAT-evaluation. some minor permit conditions have been changed on the initiative of the CA. Although the permit application did not contain all necessary information according to the Article 6 requirements, a permit that covers all Article 3 requirements was issued. This was due to the fact that the operator has a frequent and open dialogue with both CAs so additional information is immediately available. According to the operator, the permitting procedure does not always run smoothly which is, in their view, due to a lack of knowledge and a bad organisation of some CA personnel. This did not influence the quality of the permit. For the main emission sources, the ELVs appear to be in line with BAT-AELs. The current performance of the installation complies with the permit ELVs and the BAT-AELs (where applicable) based on the data provided. However, for two of the four point sources identified no data was provided to undertake an assessment of compliance. A suggestion has been made that, for defining the performance level of BAT, preference should be given to throughput-related targets. e.g. kg pollutant / tonne of fertiliser. This is possible for mature and/or relatively uniform sectors.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
S: Tumbler	Dust	2.9 mg/Nm³	20 mg/Nm³	10 – 25 mg/Nm³	Yes	Yes	GBR	Max	
	HF	2.7 mg/Nm³	3 mg/Nm³	1 – 5 mg/Nm³	Yes	Yes	GBR	Max	
	HCl	0.1 mg/Nm³	30 mg/Nm³	4 – 23 mg/Nm³	Yes	Yes	GBR	Max	
	NH_3	0.1 mg/Nm³	30 mg/Nm³	5 – 30 mg/Nm³	Yes	Yes	GBR	Max	
Notes: There are various other emission points. However, emissions monitoring data were not made available (see the detailed assessment in Appendix E2). No data were provided regarding averaging periods. Similarly the LVIC BREF does not specify an averaging period for the BAT-AELs.									
Emissions to water									
	F^-	32.66 mg/l	300 mg/l 150 mg/l		Yes		NEN 6483	Max Average	
	Ntot	0.18 mg/l	30 mg/l 15 mg/l		Yes		NEN-EN-ISO 13395	Max Average	
	COD	8.37 mg/l	250 mg/l 125 mg/l	30 – 250 mg/l	Yes	Yes	NEN 6633	Max Average	

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	Cd	0.00003 mg/l	0.01 mg/l 0.005 mg/l		Yes		NEN 6426	Max Average	
	Hg	0.00064 mg/l	0.01 mg/l 0.005 mg/l		Yes		NEN-EN-ISO 1483	Max Average	
Notes:									
Emissions to land									
Not applicable									

3.6.6 Case study 3 – Slovakia

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/SK/07. The information in this table is based on the detailed assessment for this installation in Appendix E3. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is a large chemical and fertiliser manufacturing company that falls within category 4.3 of Annex 1 of the IPPC Directive '*chemical installations for the production of phosphorous, nitrogen or potassium-based fertilisers (simple or compound fertilisers)*'. The installation manufactures a number of substances that are commonly used in the compound fertilisers in granulated and liquid forms. The installation therefore includes a large number of industrial processes including a wastewater treatment works that manages effluent streams the chemical manufacturing facilities. This installation was one of the first within the region to undergo transition into IPPC and based on the specific activity annexes within the national IPPC Act 245/2003, the operator took the decision that the installation would submit a number of separate applications for permits to delineate the 35 key site activities rather than have a single fully integrated permit covering all activities. The outcome of this is that that site currently holds 18 separate IPPC permits covering all manufacturing facilities and treatment plants although in many cases, the units are technically connected and as such could be regarded as directly associated activities. The key processes operated that are of interest to this assessment are the calcium-ammonium nitrate (CAN) manufacturing facility and a nitrogen, phosphorous, potassium (NPK) blending plant which takes the individual components and blends them at varying ratios to produce a range of fertiliser products. The facility is subject to inclusion in the Slovakian pre-accession treaty and a derogation is in place as follows: "By way of derogation from Article 5(1) of Directive 96/61/EC [now Directive 2008/1/EC], the requirements for the granting of permits for existing installations shall not apply ... until [31 December 2010], insofar as the obligation to operate ... in accordance with emission limit values, equivalent parameters or technical measures based on the best available techniques according to Article 9(3) and (4) is concerned."
Type of permit / issue date	This installation was one of the first within the region to undergo transition into IPPC and based on the specific activity annexes within the national IPPC Act 245/2003, the operator took the decision that the installation would submit a number of separate applications for permits to delineate the 35 key site activities rather than have a single fully integrated permit covering all activities. The outcome of this is that that site currently holds 18 separate IPPC permits covering all manufacturing facilities and treatment plants although in many cases, the units are technically connected and as such could be regarded as directly associated activities. This assessment focused on two key permits, covering the calcium-ammonium nitrate facility and the NPK blending plant. In addition to these two permits, the competent authority has also issued permit variations to cover the construction of a new scrubber at the CAN facility and a new permit to cover the activities following commission of the scrubber. All permits have been issued as transitional IPPC permits from existing regulatory authorisations. ▪ CAN permit issued 22/03/2006 – additional permits issued 31/07/2006 (construction of scrubber) and 14/02/2007 (to cover scrubber operation). ▪ NPK blending plant permit issued 23/10/2007.
Basis of BAT determination	The competent authority highlighted that the primary information used in the assessment of BAT during permit determination is Paragraph 5 and Annex 3 of the Integrated Pollution Prevention Law 245/2003. This sets out the basic steps and rules that a competent authority should follow in assessing BAT and developing conditions to ensure it is used by the operator to minimise pollution. For this permit, the competent authority also noted that the following sources of information were used during determination of BAT: ▪ The BREF document on Large Volume Inorganic Chemicals (LVIC) was reviewed but was at 1st draft status so the competent authority and operator both commented that it was not relied upon

	as a definitive information source; ▪ Slovak Environmental Laws on air, water and land protection (i.e. separate legislation for different environmental components); ▪ General Binding Rules (GBRs) for setting of pollutant ELVs and monitoring requirements
Permit application	
Requirements of Article 6.	An assessment of the operator's application shows that it contained all the key elements required by Article 6 of the IPPC Directive. In terms of the level of detail provided, the checks made by the competent authority upon receipt of the application required the operator to provide additional technical detail and to characterise the emissions further.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The competent authority highlighted that the steps required to determine an IPPC permit are clearly laid out in the national law (within annex 3 of the Slovakian IPPC Act 245/2003). The Ministry of Environment (MoE) has developed a permit application template that guides operators to produce applications that contain the correct information in order to facilitate determination. It was clear from the assessment that the permit contained conditions that ensured that the general principles governing the basic obligations of the operator according to Article 3 have been adequately discharged. The permit often makes reference to the requirement to comply with pre-existing general binding rules (GBRs) that govern aspects associated with e.g. waste management, implementation of BAT and site closure. The permit makes clear and unambiguous references to these laws.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	Emissions are considered within Section 6 of the permit and are addressed in a systematic manner (air, water, land, etc.). **Air:** Based on the information contained within the permit, the primary emissions to air from the two relevant process facilities (NPK blending and CAN manufacture plants) are dust (particulates) and ammonia (NH_3). The CAN plant also operates a combustion furnace for the drying of materials and this emits NO_x and CO. Based on an evaluation of the two relevant permits, there are ELVs within the permits that control the emission concentrations of air pollutants for the NPK, CAN and combustion plants. **Water:** There are no direct wastewater discharges from the permitted plants; all discharges are made to the central effluent treatment plant. The CAN manufacturing and NPK blending facilities are primarily dry processes producing only limited volumes of sanitation water. The permit for the NPK blending plant contains no conditions placing limits on water discharges as no discharges (other than sanitation) are made. The permit for the CAN plant contains two conditions relating to the discharge of waste liquids from the scrubber towers. **Land:** The permits do not contain any ELVs relating specifically to land but do contain general technical operating conditions to ensure protection from pollution. **Protection of soil and groundwater** The permits do not contain any ELVs relating specifically to protection of soil and groundwater but do contain general technical operating conditions to ensure protection from pollution. **Waste** The permits detail the exact EWC-coded wastes that are permitted to be discharged or disposed of from the installations. No limits are placed on volumes of waste. **Transboundary considerations** The permits state in Section 2.G that there are no transboundary conditions required. It is understood from discussions with the competent authority that transboundary considerations were taken in account in setting permit conditions and that there were in accordance with Article 18 of the IPPC Directive (2008/1/EC); however no evidence was seen for this as the responsibility for this lies with other competent authorities.

	Further equivalent technical parameters/measures The permits set a number of technical operating conditions that require the operator to ensure correct functioning and provision of environmental protection measures as described in the permit. This is particularly relevant for the specific pieces of abatement equipment described within the permit (scrubber) and provision of measures to ensure correct and accurate operation. A more recent permit (issued 14/02/2007) sets conditions related to the operational parameters and control of these for the recently constructed CAN plant scrubber. The permit details clear technical characteristics (such as operational efficiencies) that the operator must meet through provision of adequate measures and procedures.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** Assessment of the information provided by the operator in their technical justification of BAT report indicates that measures such as accurate temperature control, correct acid/rock ratios are used and process control measures are employed to ensure operational parameters required by the permit are met. The conditions within the permit ensure that these BAT-based measures are enforced. Conditions within the permit have required the operator to ensure such measures are taken to reduce environmental pollution through the use of BAT, namely that optimisation of process and combustion parameters in coordination with: ▪ multi-stage regenerating fabric filtration on the dolomite-magnesium grinding plant (CAN) operating to an efficiency of >99%; ▪ packed-column wet scrubber systems with an efficiency of 95-96% (Pratt-Daniel and Körting) to reduce both particulate and ammonia emissions below BAT-AEL upper ranges; ▪ high-pressure air regenerated fabric filtration to reduce dust emissions in NPK plant achieving a 95% efficiency in particulate reduction; ▪ primary boiler control measures to maintain NOx emissions to <200mg/m3, which is within the BAT-AEL range of 150-450mg/m3 for liquid fuels and control CO to below 100 mg/m3; One element that does not correlate to BAT is the imposition of a 75mg/m3 ELV for dust emissions when compared to the BAT-AEL of 10-25 mg/Nm^3. The operator has indicated that all process abatement equipment has been developed and optimised to achieve low particulate concentration levels of <10-30mg/m3. The reason provided for this variation was based upon the ELV of 75mg/m3 cited within GBRs and the competent authority indicated during the interview that it had been used because the operator had clearly demonstrated a high degree of control and use of BAT-based technologies, including 96% efficiency filtration units, to ensure dust emission concentrations are below BAT-AEL maximum values. The variable flow-related limits in the permit controlling particulate concentrations from the combustion process associated with the CAN plant do not correlate to BAT-AELs. The LCP BREF indicates that dust emissions from combustion processes <100 MW should be in the range 5-30mg/m3. The operator's submission indicates that the combustion plant was commissioned in 1960 and, taking account of the age of the equipment and local environmental conditions, the competent authority has determined that the permit enables the operation at flow-related limits of 50mg/m3 or 150mg/m3 without the use of any secondary abatement (primary control is used). **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** Although there is clear evidence of the ambient air and water quality being taken in to account by the Ministry of Environment in setting limits contained within the GBR 706/2002 Z.z. (as amended), it has not been clearly established how the local conditions, geographical location and technical characteristics of the installation are taken into account during setting of these ELVs in GBRs. Whilst reference is made in the GBRs to the use of BAT to prevent or reduce pollution, it is unclear as to whether the transposition of these ELVs in IPPC permits represents the use of BAT-based ELVs. **Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?** None observed.

	Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)? The derogation from emission limits related to maximum COD mass load values (in the Slovak Accession Treaty) enables the company to stage investments and prioritise capital expenditure on priority areas such as wastewater treatment plant upgrades, of which evidence was seen during the site visit.
Use of relevant BREF documents in setting permit conditions?	There is no direct mention of the BREF or its use within the permits. The Competent authority indicated that there is no national Slovakian guidance nor has the information within the BREF been translated directly or transposed into national laws.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permits contain conditions relating to the requirement for the operator to conduct periodic monitoring of emissions from the NPK and CAN plants. The permits both specify that monitoring should be conducted on the basis of measured mass-flows of pollutants against the permitted concentration limits. The frequency is specified at 3 or 6 years by national law in the form of GBRs (references 478/2002 Z.z., 448/2003 Z.z. (monitoring of air emissions). 296/2005 Z.z. (monitoring of water emissions)). For the monitoring of emissions of dust and ammonia from the NPK plant, the method of monitoring is explicitly stated within the permit; however for the CAN plant, methods of monitoring are not specified. The standards to which monitoring must be conducted are set out in national laws (see below) and must be followed by the accredited monitoring organisation conducting the monitoring on site. The permits both contain specific conditions that require the operator to submit the results of monitoring conducted to the competent authority. **Are the monitoring requirements sufficiently detailed?** The monitoring requirements of the permit are supported by detailed GBRs that require the Operator to report on various parameters at defined frequencies. Conditions require monitoring of emissions to air, water and land plus monitoring conditions on waste arisings and disposal, energy use, noise, sewage system integrity, site condition and operational status of plant and monitoring equipment (including calibration). Measurement points are specified within the permit to ensure accurate monitoring and all monitoring equipment (including continuous monitors) must be checked annually by a Ministry of Environment-approved certified contractor The permits do not clearly set out the methods, standards and averaging periods for pollutant measurements. **Do the monitoring requirements take into account the details contained within the BREF documents?** There was no evidence seen in the assessment that the requirements for monitoring as specified within the permits were derived directly from the BREF document. The monitoring requirements come from the Slovakian 'Component Laws' and have been integrated as formal requirements through referencing within the IPPC Law 245/2003. **Does the permit include information on duration in relation to monitoring requirements?** No reference to monitoring duration is presented in the permits; however the standards for monitoring are clearly set out for the operator to follow within GBRs and a brief visual assessment of one of these GBRs (air) indicate that monitoring standards (ISO/EN) duration and equipment are included.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Conditions in Section H of the permit relate specifically to pollution prevention measures aimed at control of significant levels of pollution that could foreseeably be released during an incident, accident or plant failure.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes, where conditions are placed in the permits that refer to the requirements to comply with GBRs, the reference is clearly given on each condition.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The competent authority stated that the limits given in the permit were set out within the Component Laws and as such required an assessment of the emissions from the installation having regard to air quality

	standards. Based on the response from the competent authority, there are no relevant EQSs (either Community-wide or national) that required stricter conditions that those achievable through the use of BAT.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	IPPC permits are valid for a maximum period of 8-10 years from issue date as stated within the IPPC Act 245/2003. The competent authority also has the right to request that the operator applies for a change in permit on the basis of the findings of inspections. Any changes to the installation operations results in a review of the permit conditions.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The competent authority stated that some parts of the application were freely posted on the Inspectorate's website during determination, particularly those aspects for which public may have an interest such as air and water quality and typical emissions. Certain technical details were omitted from publication due to the operator's request for commercial confidentiality. The Inspectorate is bound by law to disclose all submitted information upon a request by a member of the public. **Are monitoring records made available to the public?** The operator indicated that their annual environmental report and key environmental performance data is made available to members of the public via their local notice board at the front of the site entrance.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The operator is required by the permits to monitor periodically on a frequency of 3 to 6 years as stipulated within Regulation 408/2003 Z.z. The operator stated they comply implicitly with the requirements. Monitoring is undertaken on the CAN combustion plant periodically (every 6 years) for NOx and CO and particulates on an unspecified frequency to be determined on the basis of the first evidence supplied that compliance with emission limits is being achieved. All other monitoring on NPK and CAN plant (particulates and ammonia) is conducted periodically on a cycle of three or six years. It is unknown what averaging periods have been used for the monitoring.
Operator's compliance with monitoring conditions	Based on the responses of the competent authority and operator during the interview, it is understood that all requirements for monitoring are currently met by the operator. There was further discussion during the interview regarding the degree of assurance the authority and operator have that compliance is being achieved with so long a time between monitoring. The response from both parties was that the permits contain very specific conditions controlling operational parameters of plant and abatement equipment. The high specification of the abatement (96/99%) ensures that low levels of dust and ammonia are emitted and there are strict operational procedures used to maintain, and control the equipment to ensure its correct functioning. Based on the responses received from the competent authority, they appeared to be sure that the emission limits were achieved by the operator through surrogate techniques other than frequent or continuous monitoring. However, there was no evidence provided to support this conclusion.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	The historic emissions were not discussed at the meeting. The data examined on the public notice boards of the installation showed that from a baseline level in 1996, the installation has seen an approximate reduction of 40% in the emission of air pollutants (dust, SO2, NOx). The operator noted that investment has been targeted at the priority areas such as the water treatment plant and scrubber abatement system.
Current emissions of key pollutants	**This information is provided within the table below** The current emissions of the installation have been based upon information submitted by the operator following a formal request by the consultant teams to the competent authority. This information presents results of independent monitoring conducted by the MoE-certified organisations. The monitoring data is based on latest compilation but the exact date of monitoring is not known.

Assessment of Installation performance against BAT	Current performance: Conditions within the permit have required the operator to ensure measures are taken to reduce environmental pollution through the use of BAT, namely optimisation of process and combustion parameters in combination with: ▪ multi-stage regenerating fabric filtration operating to an efficiency of 99% removal is employed on the dolomite-magnesium milling plant (BAT conclusions for the dolomite grinding is to achieve <10mg/m3, the equipment indicatively achieves 0.5 - 9.5mg/m3); ▪ packed-column wet scrubber systems with an efficiency of 95-96% (Pratt-Daniel and Körting) are utilised to remove particulates (BAT-AELs are 10-25mg/m3, the equipment indicatively achieves 0.8-33mg/m3) ▪ primary combustion control measure to reduce NOx emissions to 37 mg/m3, which is below the BAT-AEL range of 150-450mg/m3 for liquid-fuelled boiler systems <100MW and reduce CO to below 100 mg/m3; ▪ pack column wet scrubbing systems reduce ammonia concentrations to below 30mg/m3, which is within the BAT-AEL range of 5-30mg/m3 although the reported ammonia figure shows a level above BAT-AEL and permit ELVs for the NPK blending plant wet Körting scrubber and condensing scrubber; ▪ staged fabric filtration achieving 95% efficiency for NPK packing lines units to reduce dust emission levels below the BAT-AEL of 10 mg/m3; ▪ dust emissions are minimised through covered conveyors and lifting equipment within the installation. **NPK Plant** Particulate emissions as monitored by the independent company and submitted by the operator show a range between 1.2 and 33.8 mg/m3, which are within the ELVs set within the permit and in one case within the BAT-AEL range of 10-25mg/m3. Ammonia emissions are considerably higher with both reported values failing to meet the ELVs or BAT-AELs. It is not clear that measures taken by the operator to correct these have resulted in significantly lower emissions as the monitoring frequency is so far apart. **CAN Plant** Emissions of particulates are in the range 0.8 to 59 mg/m3, with the scrubber units achieving a high removal efficiency that is within the BAT-AEL range. Although ammonia emissions are well controlled by the wet scrubbers, they show a wide range of results from the granulator, cooler, condenser and do not in some cases meet permit ELVs.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The permit conditions require the operator to develop a site closure plan and submit it to the competent authority no later than two months prior to predicted closure. The Competent authority is obliged to review the plan and assess its suitability in providing protection to the environment during and following closure and decommissioning. In preparation, the operator has made regular and routine samplings of the soil to establish the baseline site condition. There is currently no closure plan developed as the operator does not intend a definitive cessation of operations on the site in the forthcoming years.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the competent authority for ensuring compliance:** The competent authority reviews monitoring data that is submitted to them in accordance with the schedule given in the permit. The operator is required to produce an annual compliance report that details how they comply with permit conditions and improvement conditions that have dates and deadline set upon them. This report is reviewed by the competent authority and followed up if required. Other competent authorities (for air, water, waste) are required to review monitoring data submitted to them in accordance with national GBRs. This data is not usually reviewed by the Inspectorate other than in summary format. The inspector participating in the interview commented that, due to the significant involvement at pre-application stage and in the determination of BAT-based abatement technologies as part of the improvement conditions, they have a high degree of overall confidence that the permit conditions are complied with by the technologies. **Have sanctions or other measures been applied in cases of non compliance with the permit**

	conditions? No sanctions have been required since the issue of the permit. In the event of non-compliance, the competent authority has the power to issue notices that require plant operational changes, cessation of activity or temporary suspension of operations whilst measures are taken to rectify the non-compliance. In the event of persistent non-compliance, the competent authority may be forced to seek permanent suspension of operations through the legal court of the region. **Procedures and/or systems used by the operator to ensure compliance with permit conditions:** The operator is required by the permit to undertake such measures as necessary to ensure the minimisation of pollution in the event of malfunction or during non-normal operation. There are series of operating procedures for the process technicians to follow and decision flow charts to reduce the chance of human error at critical phases. **Procedures used or action taken by the operator in the event of non-compliance:** The operator has a set of operational procedures to follow in the event of a breach of permit conditions – this forms part of the operational 'prescriptions'. The Operator is also legally bound by national legislation to report any breach of compliance to the competent authority.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The competent authority has the power to undertake inspections on-site. No inspection has been undertaken in the past 12 months. The reason given for the lack of inspections has been the fact that many changes have been required and several permits have been updated making a meaningful inspection difficult.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Results of monitoring are available to the public on request.

Key observations from this case study assessment

- The operator made several applications for a number of IPPC permits that included the relevant information to comply with the requirements of Article 3(a)-(f). Further technical information was requested by the competent authority to support their determination of the permit conditions.
- The assessment demonstrates that the IPPC permit determination and compliance process in Slovakia is a resource-intensive exercise for the competent authority. The site holds 18 separate permits and for any measures involving changes to the plant or equipment required by the IPPC permit (to improve environmental performance/protection), the required additional construction permits add to this administrative burden. This has resulted in the competent authority having little time to undertake detailed compliance inspections.
- In setting the permit conditions, the competent authority has judged how the local environmental conditions and geographical location should be taken into account and concluded that ELVs set within GBRs are suitable to protect the environment and human health.
- This method of setting ELVs does not reflect what is achievable using BAT and in this case study, although the permit has been set in accordance with the Directive, it is unclear whether transposing ELVs from GBRs demonstrates that permit ELVs have been set based on BAT.
- The permit requires the operator to conduct monitoring; however these requirements are not directly set out in the permit but are referenced to general binding rules. These rules specify periodic monitoring based on pollutant flow and environmental damage potential and as far, as this assessment can conclude, do not take into account BAT as defined within the BAT Reference document on 'Principles of Monitoring'.
- To balance the infrequency of the monitoring (every 3 or 6 years), the competent authority have satisfied themselves that the abatement and other equipment at the installation has the technical and operational capacity to control pollutant releases to within levels that ensure compliance with ELVs.
- The assessment shows that, for a number of emission points (NPK and CAN/AN), the operator is employing BAT to prevent or, where this is not practicable, to reduce pollution to levels that pose no significant risk to the environment or human health.
- Assessment of the technologies employed shows clear links to the information presented in the BREF that can be considered BAT for these processes and the operator has demonstrated a commitment to increase environmental spend on priority areas such as wastewater treatment plant upgrading and installation of multi-stage cyclones and scrubbers to minimise emissions of dust to BAT-AEL values.
- Where BAT technologies are not being employed, emissions of ammonia are shown to be considerably above the permit ELVs and BAT-AELs. Measured data suggests that for several release points, emissions of ammonia are above permit ELVs. In response to this, the operator has upgraded and retrofitted abatement equipment. Given the infrequency of monitoring, it is unclear whether the measures taken are sufficient to ensure future compliance with ELVs (although the technologies are listed as being BAT; therefore one might assume that if they are operated correctly, ELVs will be met).

- Measured data from the NPK blending plant suggest that particulate emissions are higher than BAT-AEL ranges; however the technologies employed to abate particulates are BAT. It is unclear whether the periodic monitoring data provided for and assessed as part of this case study is fully reflective of current performance.
- The operator noted that they consider IPPC to be an effective tool in considering cross-media effects. Implementation of IPPC has directly led to the introduction of new abatement techniques e.g. scrubbers to reduce NH_3 and particulate emissions.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions Within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
NPK blending plant H101 condensing scrubber (1.14.1)	Ammonia	303.1 mg/m^3	30 mg/m^3	5-30 mg/m^3	No	No	STN 834728 STN ISO 9096 SPP-ACH 035/99	See notes below (applies to all rows)	-
NPK blending plant 'Pratt-Daniel' scrubber & cyclone(1.15.1)	Particulates Ammonia	33.8 mg/m^3 0.1 mg/m^3	C≤ 75 mg/m^3 30 mg/m^3	10-25 mg/m^3 5-30 mg/m^3	Yes Yes	No Yes	STN 834728 STN ISO 9096	-	-
NPK blending plant 'Körting' 2-stage wet scrubber (1.15.2)	Particulates Ammonia	1.6 mg/m^3 82.4 mg/m^3	C≤ 75 mg/m^3 30 mg/m^3	10-25 mg/m^3 5-30 mg/m^3	Yes No	Yes No	STN 834728 STN ISO 9096 SPP-ACH 035/99	-	-
NPK blending plant fluid cooler (1.15.3)	Particulates	7.26 mg/m^3	C≤ 75 mg/m^3	10-25 mg/m^3	Yes	Yes		-	-

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions Within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
NPK blending plant ammonium sulphate mill filtration unit (1.15.4)	Particulates	10.3 mg/m^3	C≤ 75 mg/m^3	10-25 mg/m^3	Yes	Yes		-	-
NPK blending plant F509 filtration system (1.15.5)	Particulates	1.2 mg/m^3	C≤ 75 mg/m^3	10-25 mg/m^3	Yes	Yes	STN ISO 9096	-	-
CAN plant dolomite milling cycle vents A-C (1.13.1, 1.13.2, 1.13.3)	Particulates	A. 6.8 mg/m^3 B. 59 mg/m^3 C. 50.8 mg/m^3	C≤ 75 mg/m^3	< 10 mg/m^3	Yes Yes Yes	Yes No No	EDM 2500 STN ISO 9096	-	-
CAN plant dolomite milling combustion S18 furnace (1.13.4)	Particulates SO_2 NO_x CO	No value given No value given 37 mg/m^3 1 mg/m^3	50-150 mg/m^3 No limit 200 mg/m^3 100 mg/m^3	5-30 mg/m^3 100-350 mg/m^3 150-450 mg/m^3 30-50 mg/m^3	Unknown Unknown Yes Yes	Unknown Unknown Yes Yes	AEE-URAP IPPc 02/99	-	-
CAN plant dolomite milling 9-stage N102 fabric filter (1.13.5)	Particulates	9.5 mg/m^3	C≤ 75 mg/m^3	< 10 mg/m^3	Yes	Yes	STN ISO 9096	-	-

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions Within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
CAN plant AN production 'Pratt-Daniel 32A' cyclone separator and wet scrubber (LAD) (1.20.1)	Particulates Ammonia	2.8 mg/m^3 0.25 mg/m^3	C≤ 75 mg/m^3 30 mg/m^3	No BAT conclusions on these pollutants for this process	Yes Yes	N/A	STN ISO 9096	-	-
CAN plant AN production 'Pratt-Daniel 32B' scrubber (LAD) (1.20.2)	Particulates Ammonia	0.8 mg/m^3 0.39 mg/m^3	C≤ 75 mg/m^3 30 mg/m^3	No BAT conclusions on these pollutants for this process	Yes Yes	N/A		-	-
CAN plant AN production granulator, cooler and condensers (1.20.3, 129.1, 1.29.2)	Ammonia	A. See Note 1) B. 869.9 mg/m^3 C. < 0.1 mg/m^3	C≤ 75 mg/m^3 30 mg/m^3	No BAT conclusions on these pollutants for this process	N/A No Yes	N/A		-	-

Note 1: This process emission point has ceased to function and has been removed by the operator.

Note 2: Information on monitoring extracted from the operator's technical justification of BAT reports for the AN / NPK plant scrubbers and dolomite grinder filtration units. All process emissions points are monitored every 6 years (with the exception of 1.15.3, 1.13.2 and 1.13.3, which are monitored every 3 years).

The permit does not set out what averaging periods are to be used and no information was available on what averaging periods were used for the monitoring data provided. Similarly, the LVIC BREF does not include information on averaging periods to be used.

Emissions to water

Notes: No emissions monitoring data is available as no ELVs are set for the CAN and NPK plants.

3.6.7 Case study 4 – Spain

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/ES/08. The information in this table is based on the detailed assessment for this installation in Appendix E4. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation manufactures fertilisers and is covered under Annex 1, Section 4.3 of the IPPC Directive for chemical installations for the production of phosphorus, nitrogen and potassium-based fertilisers (simple or compound fertilisers); this has been transposed into Spanish law under national legislation 6/2002 Annex 1, Section 4.3. Each region has autonomous rule and applies the regulations separately. The IPPC Directive has been implemented within the region under the legislation 4/2005 under Annex 2B Section 4.3. The four main process activities are for the production of Granulated, Water soluble, Organic Mineral Fertilisers and Liquid Bio-Stimulants. The installation has a natural gas boiler and biomass boiler, with a combined installed electrical power of 4.1MW. An ammonia plant has been installed and should be operational by 2009. Annual production in 2005 was: • Solid agro-chemical products water soluble KSC – 4,748 kg • Liquid agro-chemical products – 3,159,843 litres • Organic mineral products (fertilisers) – 2,000 tonnes The installation has a total surface area of 28,779 m^2 with a constructed total surface of 24,110 m^2.
Type of permit / issue date	The installation was previously regulated under an Activity License imposed by the Community Authority. The IPPC permit supersedes the previous licenses. The application was submitted on 24/11/2006. The permit was issued on 07/11/2007.
Basis of BAT determination	BAT for the installation was assessed using the following: ▪ BREF for Large Volume Inorganic Chemicals (LVIC): Ammonia, Acids and Fertilisers (draft May 2004) (the final BREF was published in August 2007) ▪ Economics and Cross-media effects BREF (May 2005) ▪ Large Combustion Plants BREF (May 2005) ▪ Waste Treatments BREF (August 2006) ▪ National and regional legislation which sets out ELVs for the sector.
Permit application	
Requirements of Article 6	The Competent Authority confirmed that the application contained all the key elements required by Article 6 of the IPPC Directive. The checks made by the Competent Authority upon receipt of the application required some additional information to be supplied, which included information on the biomass boiler and resultant emissions.

Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit contains most of the necessary conditions to ensure that the installation is operated in a manner that meets the requirements of Article 3. The main elements omitted from the permit were measures to avoid pollution risk upon site closure and conditions on the efficient use of energy on-site.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	The permit contains ELVs and conditions for the control of emissions to air and land. There are no ELVs set for emissions to water as all wastewater is recycled back into the process. **Air:** All air emission ELVs are set using regional legislation. ELVs have been set for the main air pollutants including SO_2, NO_x, particulates, CO, fluorides and heavy metals. The ELVs are listed in Table 1 below. In addition, a condition in the permit requires the Operator to carry out an analysis on Persistent Organic Pollutants (POPs) in the ash from the drying ovens. The Competent Authority confirmed that an ELV of 50 mg/Nm^3 for ammonia emissions will be included in the permit when the ammonia plant is operational in 2009. **Water:** All wastewater from the process is recycled back into the process and there are no discharges to surface water, therefore no ELVs have been set within the permit. **Land:** No emissions to land are permitted by this permit. **Protection of soil and groundwater:** Conditions require the Operator to monitor for leachate emissions from the leachate tank by analysing soil samples and reporting data to the Competent Authority. Appropriate containment must be installed for H_2SO_4 and liquid raw material storage, and have a capacity to retain liquids to avoid leakage and spillage. Containers with hazardous waste must not have any exit and will drain to a closed collection system. The anti-agglomerate drainage collection system must be an isolated system and collect any possible spillages. **Waste:** The permits address the arisings of waste from the various technical units through conditions placed in the permit. In addition to a number of generic conditions addressing general waste management, treatment and recovery, the permit authorises the treatment and recovery of various EWC coded wastes, giving specific quantities. **Raw Materials Storage:** The Operator is required to maintain bunds for storage of tanks and drums for raw materials and products. The bunds must have the appropriate capacity to hold the tanks' contents. **Energy efficiency:** There are no specific conditions in the permit on the efficient use of energy. A condition has been set with regards to the Operator's use of biomass. The biomass is expected to supply up to 90% of the site's requirements, with only 10% of natural gas used. **Transboundary considerations:** No conditions are included within the permit on minimisation of transboundary pollution. It is considered by the competent authority that there are no transboundary issues for this installation. **Further equivalent technical parameters/measures:** No further technical parameters have been set in the permit as alternatives to ELVs.

Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** An assessment of the permit indicated that some of the ELVs were based on BAT and it was clear how BAT was taken into account in setting these specific permit conditions. ELVs for emissions to air have been based on regional legislation, and according to the Competent Authority, these represent BAT. However, it could be argued that this is not actually the case. An ELV of 50mg/Nm^3 has been set for particulates. The BAT-AEL is 10-25 mg/Nm^3. The Competent Authority provided justification for this, stating that these ELVs are set by the regional legislation on emissions to atmosphere. In addition, the Operator has previously had difficulty meeting the limits for particulate emissions, and there have been a number of breaches. The Competent Authority set a high limit as there was uncertainty if the Operator could meet the 25 mg/Nm^3 BAT-AEL. Abatement techniques currently applied at the installation for emissions to air include cyclones, fabric filters and wet scrubbing (these represent BAT according to the LVIC BREF). Removal efficiency for particulates has not been specified in the permit, but BAT is 80% efficiency. For CO and SO_2 parameters, there are no clear BAT-AELs within the BREF document to allow comparison with permit ELVs. The ELV set for NO_x is within the BAT-AEL range. BAT is applied with regards to minimising wastewater volumes, where all wastewater (washing, rinsing and scrubbing liquors) are recycled back into the processes. Pollution prevention measures set out in the permit are considered to be based on BAT (as outlined in Question 2 of the detailed assessment for this installation).
	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? It is evident from the previous section that the Competent Authority did consider technical characteristics of the installation when setting permit ELVs for particulate emissions. It is not evident however, how the location or local environmental conditions were considered in the setting conditions and limits in the permit. The site is isolated, with no protected sites or any significant receptors for some distance. There are, according to the Competent Authority, no EQSs at an EU or Member State level that apply to this location. There is no mention in the permit of factors such as geographic location and environmental conditions having been considered in determining the permit conditions. The Ministry for the Environment in Spain were contacted to provide clarification on how technical characteristics, local factors and environmental conditions are considered at a site level when setting permit ELVs and, if the GBRs are used to directly set the ELVs, how are these environmental factors taken into account when developing or updating the GBRs. The response received from the Ministry for the Environment is provided below in the key observations for this case study. **Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?** None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** None observed.
Use of relevant BREF documents in setting permit conditions?	The BREF for Large Volume Inorganic Chemicals (draft May 2004) was used; however both the Competent Authority and the Operator consider the BREF to be too broad with not enough technical information for the Fertiliser Industry to fully assess BAT. Permit ELVs were set based on regional legislation, and this has resulted in deviation from the BREF BAT-AELs with regards to ELVs for particulate emissions specifically (although the abatement techniques applied are considered to represent BAT e.g. fabric filters). Other BREFs/Guidance used in setting permit conditions were: ▪ Economics and Cross-media effects (May 2005) ▪ Large Combustion Plants (May 2005) ▪ Waste Treatments (August 2006)

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Monitoring methods, frequencies and averaging periods have not been specified in the permit. Monitoring methods are specified in separate standards. The Operator is required to send monitoring reports twice a year to the Competent Authority. An external accredited organisation carries out monitoring every 2 months and can report this information to the Competent Authority if required. **Are the monitoring requirements sufficiently detailed?** No, the permit does not clearly set out the monitoring requirements which the operator must comply with. Monitoring methods provided in the table below have been obtained from referenced standards. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** It is not clear from the assessment how the BREF has been taken into consideration in setting the requirements for emissions monitoring. **Does the permit include information on duration in relation to monitoring requirements?** This information could not be located within the permit.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	The Operator is required to produce a plan of actions and measures for emergency situations/risks from abnormal operations.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** The ELVs are based on regional legislation (see above).The IPPC Directive has been transposed into Spanish law under national legislation 6/2002. Each region has autonomous rule and applies the regulations separately. The IPPC Directive has been implemented within the region under the legislation 4/2005.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** It is understood from discussions with the Competent Authority that there are no relevant EQSs that apply to the installation that require stricter conditions.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit is valid for 8 years. A renewal will be applied for 10 months before it expires. In practice the Competent Authority has the power to request a review of BAT at any time and operational conditions are regularly reviewed following site inspections. Changes to the permit conditions may be made through standard substantial variations. The Competent Authority stated that there will be a variation to the permit for the ammonia plant, setting an ELV for ammonia emissions to air and other control measures.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes. The application and decision document is made available in paper format in an office providing public access during set hours. **Are monitoring records made available to the public?** Yes. Records are made available upon request and are available in paper format within the public register.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	Monitoring is carried out by an external accredited organisation every 2 months on all air emission point sources and all parameters specified in the table below. The Operator also undertakes automatic monitoring on-site and maintains records of monitoring results. Annual emissions monitoring data is provided to the Competent Authority.
Operator's compliance with monitoring conditions	The Competent Authority and Operator stated that all monitoring is undertaken in accordance with the requirements of the permit conditions. This cannot be verified as the permit does not set out detailed monitoring requirements, but references the appropriate standards. It was not possible within the time constraints of this assessment to review the standards referenced in the permit.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	Emissions monitoring conducted in June 2006 compared with monitoring data from January - August 2008 shows there has been an overall increase in particulate emissions from the majority of point sources, with the most significant increases from the phosphate mill, charge areas 1 and 2 and the water soluble production unit. A comparison could not be made of particulate emissions from the drying ovens, as pre-IPPC data was not made available for this point source. There have been a number of breaches of ELVs for particulate emissions from point source phosphate mill and charge area 1 in July/August 2008. Fluoride emissions have also slightly increased. CO, NO_x and SO_2 emissions from the drying ovens have decreased over this period. Further information on emissions pre-IPPC is provided in Question 16 of the detailed assessment in Appendix E4.
Current emissions of key pollutants	**This information is provided within the table below.** The results presented in the table below show monitoring data for the period January - August 2008. For the purposes of this assessment, an average was taken over this 8 month period. It must be noted that, despite requests, details of the actual averaging periods applied at the installation were not provided and therefore a useful comparison against BAT-AELs is difficult to make.
Assessment of Installation performance against BAT	**Current performance:** Particulate emissions from point sources No.1 Phosphate Mill, No. 8 Charge area 1, No. 10 Charge area 2 and No. 12 Water solubles KSC process unit, are not within the BAT-AEL ranges. There have been a number of breaches of ELVs for particulate emissions from the phosphate mill and charge area 1 in July/August 2008. For those other emissions where comparable BAT-AELs exist, the performance on the installation is within or below the BAT-AEL ranges. NO_x emissions are well below the ELV and within the BAT-AEL range. Fluorides are below permit ELVs and at the upper limit of the BAT-AELs. A high SO_2 limit of 500 mg/Nm^3 has been set in the permit for the drying ovens; there are no BAT-AELs in the LVIC BREF to compare this value with. The BREF for Large Combustion Plants sets a SO_2 BAT-AEL of 20-200 mg/Nm^3.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	There are no specific conditions in the permit to indicate that site closure measures have been considered. The Competent Authority and the Operator stated that no provisions have been made for this. However, there is an agreement in place with the Government Department for the Operator to monitor soils for leachate contamination (from a previous process, and is stored in a cell onsite). Monitoring is undertaken and reported to the Competent Authority annually. A small amount of the leachate is tested and reintroduced back into the process.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The procedures by which the Competent Authority ensures compliance are through review of annually reported monitoring data and reports, audits, and on-site inspections. An external organisation carries out site monitoring measurements every 2 months and if requested, can report this information to the Competent Authority. The Competent Authority can carry out their own spot sampling if they deem it necessary. Normally the Competent Authority would carry out one major site inspection once a year. It is not known how the frequencies of these inspections are determined. The CA has the power and a duty to enforce the regulations and may adopt a wide range of methods for doing this, which includes the use of powers to serve notices/shut-down/prosecute operators that do not comply. Where there are concerns of ELVs being breached, as for particulate emissions, the Competent Authority has requested that the Operator provide evidence that actions are being taken to prevent any incidents of non-compliance and implement these actions within a defined timescale. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** There have been breaches of the ELVs for particulates in the past. The Competent Authority has placed conditions requesting the implementation of a preventative maintenance plan to address these issues. It is understood from comments during the interview, that there have been no fines or formal warnings given. A fine would normally be given in the case of non-compliance. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The Operator has internally-drafted EMS procedures that detail the actions that are required to ensure compliance with legal requirements. Training is provided to staff on operating procedures. Emissions are monitored and any breach of a limit is investigated. In addition, there is a meeting daily in which environmental and technical operating issues are discussed, and non-compliance with permit ELVs would be discussed here **Procedures used or action taken by the operator in the event of non-compliance** The Operator has drafted internal procedures for reporting non-compliances. In the event of non-compliance, the Operator would notify the Competent Authority immediately and the relevant non-conformance forms would be completed. This is part of compliance under the EMS. A preventative maintenance plan is in place, which has recently been revised and implemented.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** There have been no audits undertaken since issue of the permit. Normally, the Competent Authority would undertake a site inspection once a year. The Operator would assist the Competent Authority with these inspections.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Results of monitoring are held on the public register and are available upon request. No formal publication of the information is made by the Competent Authority or the Operator.

Key observations from this case study assessment

- The operator submitted an application for an IPPC permit that contained the key elements required by Article 6.
- The determination of the permit was made using BREF for Large Volume Inorganic Chemicals (LVIC): Ammonia, Acids and Fertilisers (draft May 2004) (the final BREF was published in August 2007). Other BREFs were also used. National and regional legislation were also used to sets limits within the permit (GBRs).
- The conditions within the permit fail to fully address all the requirements of Article 3; specifically no conditions have been placed in the permit addressing measures to avoid pollution risk upon site closure and conditions on the efficient use of energy on-site.
- The permit contains ELVs for the main pollutants to air in accordance with Article 9(3) and the ELVs are set using limits set out in regional legislation and with consideration of BAT-AELs in the BREF document.
- The ELV within the permit for particulate emissions exceeds the BAT-AEL range. There have been breaches of permit ELVs for particulate emissions, and it is believed that BAT is currently not being applied with regards to control of this pollutant (although cyclones and fabric filters are in place). The implementation of the preventative maintenance plan should see reductions in particulate emissions,

and it is the opinion of the Operator that ELVs will be met once the implementation plan is fully embedded within 2009.

- There are no ELVs for water emissions as all process wastewater is recycled back into the process.
- Emissions monitoring conducted in June 2006 compared with monitoring data from January – August 2008 shows there has been in an overall increase in particulate emissions from the majority of points sources, with the most significant increases from the phosphate mill, charge area 1 &2 and water soluble production unit.
- There is insufficient information in the permit on monitoring methods, frequencies and averaging periods. Actual averaging periods applied at the installation were not provided. It is noted that the LVIC BREF does not include information on duration / averaging time for the BAT-AELs.
- There is no evidence in the permit of local factors or environmental conditions having been considered in the determination of permit conditions and limits. Clarification on this was requested from the Ministry for the Environment in Spain on how these factors are considered at a site level and when setting limits based on regional and national GBRs. The response received in February 2009 from the Ministry for the Environment is provided below:

  'All our competent authorities issuing IPPC permits are taking into account the local environmental conditions; in fact, some of them have developed a methodology for the calculation of the Emission Limit Values. Andalucía for instance obtains the ELV through a variety of calculation formulas that take into account not only the local conditions but the geographic location and the technical characteristics too.

  Other Autonomous [Communities have] developed a few more tools to fit the conditions set in the IPPC permits with the real local conditions and technologies of the companies in our region:

  The evaluation of the local [effects of] atmospheric emissions is a net of measurements of [emission] values for general pollutants in air. This air quality monitoring net [is] set all around the main problematic zones and registers the pollutant levels continuously. In a specific case of areas with an important number of IPPC [installations], there are few monitoring points around the biggest industrial complexes. This tool allows us to check if there are local problems in [air quality] and set in the IPPC permit some specific conditions to the companies that contribute more to cause this problem. For example, if there is a problem with air quality caused by particulate matter, the permit for the operators that are likely to emit this pollutant will include some specific conditions to avoid or reduce their emissions. These conditions could even include the obligation of implementing a treatment system. So this tool takes into account the local environmental conditions (air quality) and the technical characteristics of the installation (especially when a treatment system is required).

  Another tool that is used is the monitoring of surface and groundwater quality in a similar way to the previous tool. For example, different ELVs are set depending on the final destination of wastewater (river, sea, …) and the dispersion method used to release this water. Like the previous example, if an operator foresees that the final destination of its wastewater will be a zone with some water quality problems, its permit will include some specific conditions to avoid the problem getting worse, even some treatment systems could be required. This tool also takes into account the local environmental conditions (water quality) and the technical characteristics of the installation.

  Most of authorities take into account the following:

  - *the technical characteristics of the installation, in order to compare them with the BAT gathered in the BREF and the National BAT Guides;*
  - *the local environmental and geographical conditions through the application of local and regional legislation: [...] the population distribution, the available information on the soil characteristics and customs, as well as vegetation inventories, the meteorological and geomorphologic conditions, the localization of the main pollutant activities, the localization of the areas classified as specially sensitive due to its cultural and ecological value and the air quality.*
  - *Reference values of the BREF, as well as ELV of sectoral national or European legislation.*

  All [these] factors are taken into account when updating environmental legislation'.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
No.1 Phosphate Mill	Particulates	49.98 mg/Nm^3 [1]	50 mg/Nm^3	10-25 mg/Nm^3	Yes (if average is taken – see note 1)	No	Automatic measurement- Isokinetic measurement	Not available (see notes) (applies to all rows)	N/A
No.2 Mixer 1	Particulates	15.85 mg/Nm^3	50 mg/Nm^3	10-25 mg/Nm^3	Yes	Yes	Automatic measurement- Isokinetic measurement		N/A
	Fluorides	2.46 mg/Nm^3	5 mg/Nm^3	1-5 mg/Nm^3	Yes	Yes	Selective electrode method		
No.3 Mixer 2	Particulates	6.22 mg/Nm^3	50 mg/Nm^3	10-25 mg/Nm^3	Yes	Yes	Automatic measurement- Isokinetic measurement		N/A
	Fluorides	4.04 mg/Nm^3	5 mg/Nm^3	1-5 mg/Nm^3	Yes	Yes	Selective electrode method		
No.4 General	Particulates	4.36 mg/Nm^3	50 mg/Nm^3	10-25 mg/Nm^3	Yes	Yes	Isokinetic measurement		N/A
	Fluorides	0.20 mg/Nm^3	5 mg/Nm^3	1-5 mg/Nm^3	Yes	Yes	Selective electrode method		

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
No.5 Drying ovens	Particulates	16.71 mg/Nm^3	50 mg/Nm^3	10-25 mg/Nm^3	Yes	Yes	Automatic measurement- Isokinetic measurement		N/A
	Fluorides	0.47 mg/Nm^3	5 mg/Nm^3	1-5 mg/Nm^3	Yes	Yes	Selective electrode method		N/A
	CO	20.17 mg/Nm^3	100 mg/Nm^3	No BAT-AEL in BREF	Yes	N/A	Gas analysers		N/A
	SO_2	12.86 mg/Nm^3	500 mg/Nm^3	No BAT-AEL in BREF	Yes	N/A	Gas analysers		SO_2 at 3% O_2
	NO_X	19.51 mg/Nm^3	200 mg/Nm^3	100-425 mg/Nm^3	Yes	Yes	Gas analysers		NO_x at 3% O_2
	Organic compounds	0.51 mg/Nm^3	50 mg/Nm^3	No BAT-AEL in BREF	Yes	N/A	Not given in permit		N/A
No.6 Filer zone	Particulates	8.77 mg/Nm^3	50 mg/Nm^3	10-25 mg/Nm^3	Yes	Yes	Automatic measurement- Isokinetic measurement		N/A
No.7 Cooler	Particulates	12.75 mg/Nm^3	50 mg/Nm^3	10-25 mg/Nm^3	Yes	Yes	Automatic measurement- Isokinetic measurement		N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
No.8 Charge area 1	Particulates	26.10 mg/Nm^3 [2]	50 mg/Nm^3	10-25 mg/Nm^3	Yes (if average taken – see note 2)	No	Automatic measurement-Isokinetic measurement		N/A
No.9 Drying big-bag	Particulates	3.10 mg/Nm^3	50 mg/Nm^3	10-25 mg/Nm^3	Yes	Yes	Automatic measurement-Isokinetic measurement		N/A
No.10 Charge area 2	Particulates	25.25 mg/Nm^3 [3]	50 mg/Nm^3	10-25 mg/Nm^3	Yes (see note 3)	No	Automatic measurement-Isokinetic measurement		N/A
No.11Gas boiler [4]	N/A	N/A	No permit ELV	N/A	No permit ELV	N/A	N/A		N/A
No.12 Water-solubles KSC production unit	Particulates	25.19 mg/Nm^3	50 mg/Nm^3	10-25 mg/Nm^3	Yes	No	Isokinetic measurement		N/A
	Cd	No data available	0.2 mg/Nm^3	No BAT-AEL in BREF	Not known	N/A	Not given in permit		N/A
	Cu	No data available	5 mg/Nm^3		Not known	N/A	Not given in permit		
	Cr	No data available	5 mg/Nm^3		Not known	N/A	Not given in permit		

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	Ni	No data available	1 mg/Nm^3		Not known	N/A	Not given in permit		
	Pb	No data available	5 mg/Nm^3		Not known	N/A	Not given in permit		
	V	No data available	No permit ELV		No permit ELV	N/A	Not given in permit		
No.13 Biomass boiler[4]	Particulates	27.76 mg/Nm^3	No permit ELV	10-25 mg/Nm^3	No permit ELV	N/A	N/A		

Notes:

Information on averaging period and reference conditions has been requested from the Operator, but has not been received. The LVIC BREF does not include information on averaging periods.

[1] This value is an average of 8 months of monitoring data. Data from July/August showed a breach of the ELV (a value of 62.67 mg/Nm^3)

[2] This value is an average of 8 months of monitoring data. Data from July/August showed a breach of the ELV (a value of 55.96 mg/Nm^3)

[3] July/August data showed value close to ELV (value of 49.16 mg/Nm^3 shown)

[4] No specific limits have been set for the natural gas boiler or the biomass boiler in the permit. Annex II Section 1.1 of the summary of the permit states that these are considered emergency emissions. The Competent Authority stated that point source 13 biomass boiler is non-catalogued/non classified as it is not considered as systematic according to regional legislation 6/2002. Therefore, ELVs have not been set for this point source. ELVs have, however, been set for the drying ovens (point source No. 5).

Emissions to water

There are no ELVs set within this permit for emissions to water. All wastewater is recycled back into the process.

3.6.8 NPK/CN fertiliser manufacture – summary

Based on the four case study assessments above (in Italy, the Netherlands, Slovakia and Spain), the following key points can be drawn out:

- Permit ELVs have been set for water for two of the installations[47]. Where relevant BAT-AELs are available from the LVIC-AAF BREF, these permit ELVs are consisten with the BAT-AEL range. Emissions monitoring data were only available for water for one of these installations.
- In relation to air emissions, the majority of permit ELVs are consistent with the BAT-AEL ranges, with the following exceptions:
  - HCl (Italy);
  - CO (Slovakia);
  - Particulates (Slovakia, Spain).
- With regard to emissions monitoring, the monitoring undertaken generally complied with the permit conditions for all installations, with the exception of one installation where monitoring was not undertaken for some of the emission points.
- The LVIC-AAF BREF does not specify the averaging periods to be used. Little information was made available across all four installations regarding the averaging periods that are expected to apply to the permit ELVs and the monitoring data. Operators expressed that this was an area of uncertainty for them.
- Across the four installations, the monitoring data provided indicates that emissions appear to be below the permit ELVs and within the BAT-AEL ranges, with the following exceptions:
  - Emissions of particulates from several sources at both the Slovakian and Spanish installations are above the BAT-AEL range;
  - Emissions of ammonia are above the permit ELVs for two sources at the Slovakian installation and are above the BAT-AEL ranges for several sources at this installation.
- Inspections were undertaken by the competent authority for three of the installations, ranging from less than one per year to more than four per year, based on the year preceding the interviews. The remaining installation had not been inspected in that year.

The table below provides an indicative summary of the standards and emissions to air of key pollutants from this sector. In particular, it includes information on the relevant BREF BAT-AELs; ELVs set in permit conditions; and

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47 In the case where ELVs for water were not included, this was because the installation units under assessment produced only very limited quantities of general sanitation water and recycled all process water into the system.

actual installation performance. This information is only intended to be indicative of the broad ranges of these values and the reader is referred to the assessments for each installation for further information on the emissions from specific sources and the applicable permit ELVs and BAT-AELs.

Table 3.10 Indicative information on emissions of certain air pollutants from NPK/CN fertiliser manufacture installations (BAT-AELs, permit ELVs and actual installation performance)

Member State	Pollutant	BAT-AEL (Note 1)	Permit ELVs (Note 1)	Actual emissions (Note 1)
Phosphate rock digestion, sand washing, CNTH filtration				
Italy	NO_x	100 - 425 mg/m^3	250 mg/m^3	8 - 22 mg/m^3
Italy	HF	0.3 - 5 mg/m^3	None	No data
Neutralisation, granulation, drying, coating, cooling.				
Italy	NH_3	5 - 30 mg/m^3	30 mg/m^3	19 - 26 mg/m^3
Netherlands	NH_3	5 - 30 mg/m^3	30 mg/m^3	0.1 mg/m^3
Slovakia	NH_3	5 - 30 mg/m^3	30 mg/m^3	0.25 - 870 mg/m^3
Spain	NH_3	5 - 30 mg/m^3	None	No data
Italy	HF	1 - 5 mg/m^3	None	No data
Netherlands	HF	1 - 5 mg/m^3	3 mg/m^3	2.7 mg/m^3
Slovakia	HF	1 - 5 mg/m^3	None	No data
Spain	HF	1 - 5 mg/m^3	5 mg/m^3	0.2 - 4 mg/m^3
Italy	Dust	10 - 25 mg/m^3	20 mg/m^3	1.2 - 6.1 mg/m^3
Netherlands	Dust	10 - 25 mg/m^3	20 mg/m^3	2.9 mg/m^3
Slovakia	Dust	10 - 25 mg/m^3	75 mg/m^3	1 - 59 mg/m^3
Spain	Dust	10 - 25 mg/m^3	50 mg/m^3	3 - 49.98 mg/m^3
Italy	HCl	4 - 23 mg/m^3	30 mg/m^3	0.4 - 0.5 mg/m^3
Netherlands	HCl	4 - 23 mg/m^3	30 mg/m^3	0.1 mg/m^3
Slovakia	HCl	4 - 23 mg/m^3	None	No data
Spain	HCl	4 - 23 mg/m^3	None	No data

Notes:

1) Where there are several points at which emissions are measured and ELVs set, the range is quoted. No averaging periods are specified in the LVIC-AAF BREF and no information was made available on the averaging periods applying to permit ELVs or emissions monitoring data.

4. Implementation in the mineral oil and gas refinery sector

4.1 Overview

As detailed in Section 2 of this report, Task 3 of the project involved both an assessment of the overall state of implementation of the IPPC Directive in this sector and an assessment of individual installations. The overall assessment included a consideration of the extent to which the BAT conclusions of the BREF are being implemented, the current performance of installations compared with BAT as determined in the BREF and the possible differences amongst individual installations or more generally amongst Member States.

This report provides:

- A summary of the main findings;
- A background to the refineries sector;
- A background to the refineries BREF and summary conclusions;
- A sector-wide analysis;
- An analysis of individual installations (case studies);
- A discussion of findings concerning the sector-wide and individual installation analysis and
- Conclusions.

4.2 Summary of the findings

The implementation of the IPPC Directive for existing installations in the mineral oil and gas refineries sector began relatively late. Significant progress in the permitting process in some Member States has been made over the last two to three years but progress in some Member States is still significantly less than in others. Taking into account the fact that the implementation of certain measures has to take place during shut down or turnaround of installations, a further decrease of emissions is expected to take place in the coming years as a result of the implementation of the Directive.

With regard to emissions to air from the sector, a wide variation of load bubbles (as described below) has been observed, both at an individual installation as well as at a country-wide level. These differences can not always be explained by refinery complexity and/or crude slate used, indicating that requirements to reduce emissions (EU-wide or nationally, e.g. imposed via permit conditions and/or GBRs) also have a major influence on the level of emissions from the sector. Progress in lowering emissions to air has been made over recent years for the pollutants

SO_2 and NO_x, but a significant number of installations still exceed all of the load bubble benchmarks specified in the BREF document (note that these benchmarks do not have the same status as BAT-AELs and that, in some cases, different benchmarks have been proposed by different Member States, as described in Section 4.4, below). Based on individual refinery emission data:

- in 2004, 76 out of 91 (83%) individual refineries exceeded the SO_2 load bubble benchmark and 61 out of 91 (67%) exceeded the NO_x load bubble benchmark;
- in 2006, 57 out of 63 (90%) individual refineries exceeded the SO_2 load bubble benchmark and 39 out of 62 (63%) exceeded the NO_x load bubble benchmark[48].

These data suggest an apparent lack of progress over time, although there are likely to be differences in the coverage and quality of emissions data reported (to EPER) over time for the individual refineries.

Regarding emissions to water, concentrations and load bubbles also vary widely on an individual installation level, but a significantly larger share of installations already fall within the load bubble benchmarks specified in the BREF document compared to emissions to air (emissions in line with BAT-AEL were 86% for total-N, 72% for COD and 55% for BOD).

Based on the data collected for the sector as a whole, as well as for the 11 installations covered by this study, it is clear that overall there appears to be a slow uptake of BAT for the mineral oil and gas refineries sector.

The setting of BAT-based ELVs in the refinery sector is often not straightforward as in many cases a petrochemical plant (covered by the large volume organic chemicals BREF) is heavily integrated with the refinery. The numerous split views on BAT-AELs in the refineries BREF document also do not contribute to a swift/consistent use of the BREFs' conclusions into permit conditions and this has been used as a justification for not imposing ELVs in line with BAT-AEL in certain cases.

Clearer conclusions in the updated BREF document would likely help to improve the usability of the BREF and thus to ensure a more consistent implementation of the Directive across the EU.

4.3 Background to the sector

4.3.1 Refinery operations

The purpose of a refinery is to transform crude oil into useful saleable products, such as:

- Fuels for cars, trucks, planes, ships and non-road machinery;

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48 The reasons for the apparent changes between 2004 and 2006 are not clear.

- Combustion fuels for the generation of heat and power for industry, tertiary sector and households;
- Raw materials for the (petro)chemical industry;
- Specialty products such as lubricating oils, paraffins/waxes and bitumen and
- Energy as a by-product in the form of heat (steam) and power (electricity).

In order to achieve this transformation, the raw materials are processed in a number of different process facilities. The combination of these processing units to convert crude oil into products, including its supporting units and facilities, is referred to as a refinery.

Petroleum refining begins with the distillation, or fractionation, of crude oils into separate hydrocarbon groups. The resultant products are directly related to the characteristics of the crude oil processed. Most distillation products are further converted into more usable products by changing the size and structure of the hydrocarbon molecules through cracking, reforming, and other conversion processes as discussed further below. These converted products are then subjected to various treatment and separation processes such as extraction, hydrotreating and sweetening to remove undesirable constituents (including sulphur, nitrogen and metals such as nickel and vanadium) and to improve product quality. Complex refineries incorporate fractionation, conversion, treatment and blending operations.

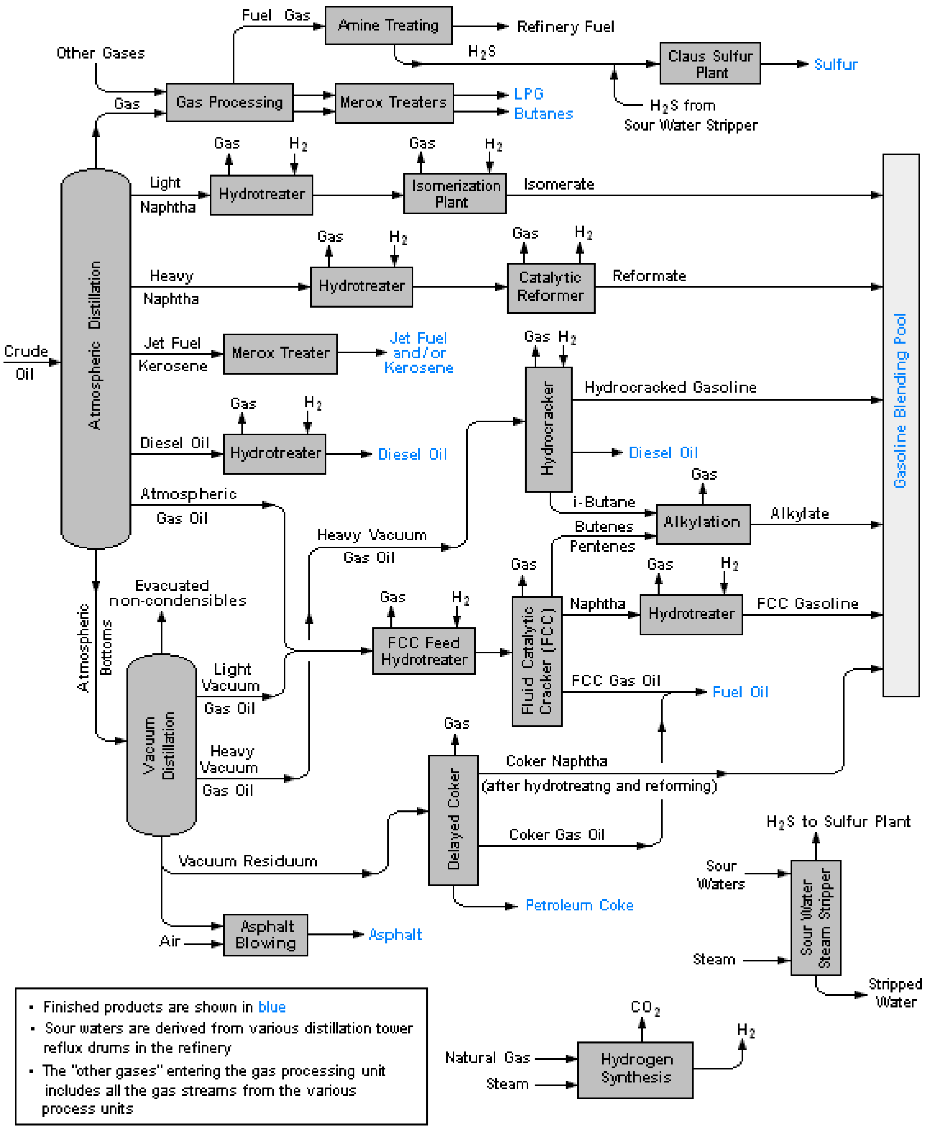
Petroleum refining processes and operations can be separated into five basic areas:

- Fractionation (distillation) is the separation of crude oil in atmospheric and sometimes also vacuum distillation towers into groups of hydrocarbon compounds of differing boiling-point ranges called “fractions” or “cuts”.
- Conversion processes change the size and/or structure of hydrocarbon molecules. These processes include:
  - decomposition (dividing) by thermal and catalytic cracking;
  - combining through alkylation and polymerization; and
  - rearranging with isomerization and catalytic reforming.
- Treatment processes are intended to prepare hydrocarbon streams for additional processing and to prepare finished products. Treatment may include the removal or separation of aromatics and naphthenes as well as impurities and undesirable contaminants. Treatment may involve chemical or physical separation such as dissolving, absorption or precipitation using a variety and combination of processes including desalting, drying, hydrodesulfurizing, solvent refining, sweetening, solvent extraction and solvent dewaxing.
- Formulating and blending is the process of mixing and combining hydrocarbon fractions, additives and other components to produce finished products with specific performance properties.

- Other Refining Operations include: light-ends recovery; sour-water stripping; solid waste and wastewater treatment; process-water treatment and cooling; storage and handling; product movement; hydrogen production; acid and tail-gas treatment; and sulphur recovery.

A refinery process chart, indicating the main processes and their interconnection is provided in Figure 4.1. Not all processes in this figure are in operation at all individual refineries.

Figure 4.1 Refinery process chart[49]



49 Source: http://en.wikipedia.org/wiki/Refinery.

Auxiliary operations and facilities include: steam and power generation; process and fire water systems; flares and relief systems; furnaces and heaters; pumps and valves; supply of steam, air, nitrogen, and other plant gases; alarms and sensors; noise and pollution controls; sampling, testing, and inspecting; and laboratory, control room, maintenance and administrative facilities.

The energy (heat and electricity) required for all processing steps is generated in furnaces and boilers, gas and steam turbines and cogeneration plants. Refinery fuel gas and liquid refinery fuel, generated by the refinery itself but sometimes also supplemented with natural gas, are the dominant fuels used for energy generation. Refinery fuel gas (methane, ethane and ethylene in combination with excess hydrogen) is internally generated in the different refinery processes and collected in the refinery gas system; refinery gas has to be used quickly and cannot normally be sold as a valuable product. Liquid refinery fuel is a mixture of the residues from atmospheric and/or vacuum distillation and conversion and cracking processes.

4.3.2 The refinery sector in Europe

In Table 4.1 an overview is given of the number of refineries in each Member State according to a variety of sources. The observed differences amongst the data from different sources can be explained as follows:

- Facilities only have to report their data to EPER when the emission of a certain pollutant exceeds the reporting ceiling, meaning that a number of small installations may not be accounted for in the EPER database.
- Some chemical facilities or large hydrocarbon storage facilities are sometimes included under ‘mineral oil and gas refineries’ in EPER. This is mainly the case for France (2001 data) and the UK.
- Some facilities in Germany and Italy seem to be split into several parts (most likely because the facility is located in more than one municipality) in the EPER database, while other sources consider them to be a single complex.

Figure 4.2 provides an overview of the refineries' complexity (Nelson Complexity Index, NCI[50]) as a function of their capacity (Nameplate Capacity, NPC). The refineries are grouped according to the eight regions which are generally accounted for in studies by Concawe:

- BEN – Benelux: Belgium, The Netherlands, Luxemburg;
- EEU – Eastern Europe: Czech Republic, Hungary, Poland, Slovak Republic;
- FRA – France;
- IBE – Iberia: Portugal, Spain;
- ITG – Mediterranean: Cyprus, Italy, Greece, Malta, Slovenia;
- MEU – Middle Europe: Austria, Germany;
- SCA – Scandinavia: Denmark, Estonia, Finland, Latvia, Lithuania, Sweden and
- UKI: Ireland; United Kingdom.

As the data presented in Figure 4.2 are derived from OGJ (2001), Bulgaria and Romania are added as a separate category.

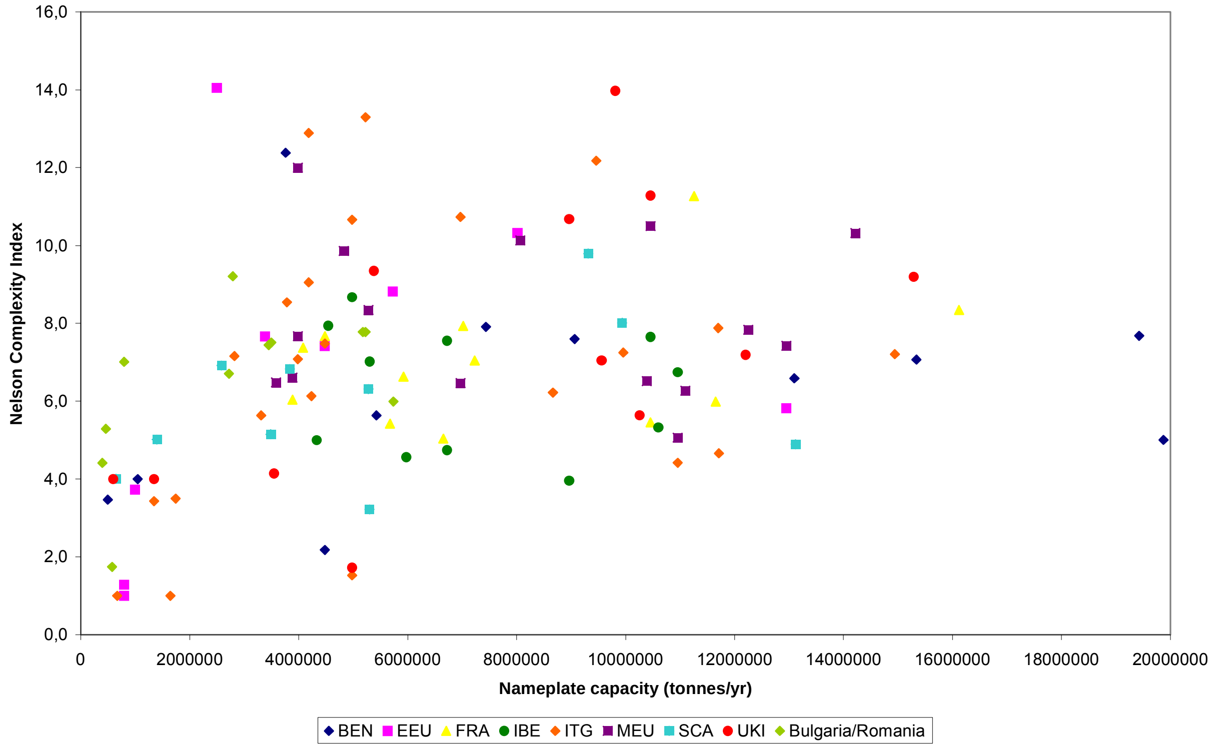
50 The Nelson Complexity Index (NCI) assigns a complexity factor to each major piece of refinery equipment based on its complexity and cost in comparison to crude distillation, which is assigned a complexity factor of 1.0. The complexity of each piece of refinery equipment is then calculated by multiplying its complexity factor by its throughput ratio as a percentage of crude distillation capacity. Adding up the complexity values assigned to each piece of equipment, including crude distillation, determines a refinery's complexity on the Nelson Complexity Index. Although originally developed for cost estimation purposes, the NCI has become a generally accepted indicator of the possibility of the refinery for further treatment of the various fractions (conversion). The Nelson Complexity Index indicates not only the investment intensity or cost index of the refinery but also its potential value addition. Thus, the higher the index number, the greater the cost of the refinery and the higher the value of its products.

Table 4.1 Overview of the number of mineral oil and gas refineries in each Member State according to different sources

Member State	BREF (2003)	IVL (2005)[51]	EPER (2001)	EPER (2004)	OGJ (2001)
Austria	1	1	1	1	1
Belgium	5	5	5	3	5
Bulgaria	No data	No data	No data	-	1
Cyprus	No data	No data	No data	-	1
Czech Republic	No data	No data	No data	2	4
Denmark	2	2	2	2	2
Estonia	No data	No data	No data	1	-
Finland	2	2	2	2	2
France	15	13	31	18	13
Germany	17	17	22	21	17
Greece	4	4	4	4	4
Hungary	No data	No data	No data	1	2
Ireland	1	1	1	1	1
Italy	17	17	17	17	17
Latvia	No data	No data	No data	-	-
Lithuania	No data	No data	No data	1	1
Luxemburg	-	-	-	-	-
Malta	No data	No data	No data	-	-
Netherlands	6	6	5	5	6
Poland	No data	No data	No data	5	4
Portugal	2	2	2	2	2
Romania	No data	No data	No data	-	10
Slovak Republic	No data	No data	No data	1	1
Slovenia	No data	No data	No data	-	1
Spain	10	9	10	10	9
Sweden	5	5	6	5	5
UK	13	11	46	38	11
Total	**> 87**	**> 84**	**> 108**	**102**	**109**

51 IVL Swedish Environmental Research Institute

Figure 4.2 Nelson complexity index as a function of nameplate capacity of European refineries



From the data in Figure 4.2, it is clear the most of the European refineries have a nameplate capacity ranging from 250,000 to 1,350,000 tonnes/year and a complexity index ranging between 4 and 10. According to region, Iberia and Bulgaria-Romania have relatively few large refineries; Iberia, Scandinavia and Bulgaria-Romania do not have refineries of a high complexity (see also Table 4.2).

Table 4.2 Distribution of nameplate capacity and Nelson complexity index according to region

Region	Nameplate capacity (tonnes/year)			Nelson complexity index		
	Minimum	Median	Maximum	Minimum	Median	Maximum
BEN	498,000	7,437,232	19,870,200	2.2	6.6	12.4
EEU	796,800	3,386,400	12,948,000	1.0	7.4	14.1
FRA	3,884,400	6,840,030	16,117,421	5.0	6.8	11.3
IBE	4,332,600	6,723,000	10,956,000	4.0	6.7	8.7
ITG	672,300	4,482,000	14,940,000	1.0	7.2	13.3
MEU	3,585,600	8,067,600	14,217,900	5.1	7.7	12.0
SCA	647,400	4,556,700	13,118,316	3.2	5.7	9.8

Region	Nameplate capacity (tonnes/year)			Nelson complexity index		
	Minimum	Median	Maximum	Minimum	Median	Maximum
UKI	597,600	9,262,800	15,288,600	1.7	7.1	14.0
Bulgaria/Romania	398,400	2,788,800	5,738,952	1.7	7.0	9.2

Regions are as described in Section 4.3.2 of this report.

4.4 Background to the BREF and summary conclusions

4.4.1 Overview

The BREF document on mineral oil and gas refineries presents the results of an exchange of information between EU Member States and industries concerned on best available techniques (BAT), associated monitoring and developments in both. The final version of the BREF document was issued in February 2003. The process of developing the BREF involved experts from the Joint Research Centre (JRC), Member States, industry and NGOs.

4.4.2 BAT-associated emission levels for SO_2

The BREF document has defined a number of techniques considered to be BAT and having an impact on the emissions of SO_2 such as:

- Improving energy efficiency;
- Use of clean (desulphurised) refinery fuel gas and supply to the rest of the refinery energy demand with either liquid fuel (combined with control and abatement techniques) or other fuel gases such as LPG and natural gas;
  - Catalytic cracker: Reduction of SO_2 emissions to 10-350 mg/Nm³ by means of a suitable combination of: Hydrotreatment of the feedstock (when technically and economically viable); using a DeSOx catalyst additive; and using FGD of the regenerator gas with 95-99% efficiency, especially if feedstock hydrotreatment is not applicable.
- Coking process:
  - Convert carbonyl sulphide (COS) emissions from the coke gas of flexicokers to H_2S;
  - Route sour gas produced to sulphur treatment;
  - Reduce SO_2 emissions from the calcination flue gas to 25-300 mg/Nm³ by applying FGD techniques (efficiency >90%).
- Energy system:

- Increase the proportion of clean fuels used by a suitable combination of: Maximisation of the use of refinery fuel gas with low H_2S content (20-150 mg/Nm^3 through amine treatment); balance and control of the refinery fuel gas system with make-up available from sulphur free sources (LPG, imported gas, etc.); and use of desulphurized heavy fuel oil.

- Combustion systems (boilers, heaters and gas turbines): Increase the proportion of clean fuels used; reach an emission level of 5-20 mg/Nm^3 when using clean refinery fuel gas; and achieve an emission level of 50-850 mg/Nm^3 when using liquid fuels by means of a suitable combination of hydrodesulphurisation of liquid fuels and application of flue gas desulphurisation.

- Efficient operation of the sulphur recovery unit:

  - Application of staged SRU including tail gas treatment with a recovery efficiency of 99.5-99.9%;

  - Reach a utilisation factor of at least 96%, including the major planned turnaround maintenance.

- Reduction of SO_2 emissions from the small contributors (e.g. flaring, gases from vacuum ejectors burnt in furnaces) when they become a significant part of the total emissions and when their abatement is cost-effective.

The refineries BREF document only specifies refinery wide benchmarks[52] (concentration or load bubbles[53]) for SO_2 and also specifies process-specific BAT-AELs.

Table 4.3 provides an overview of the concentration and load bubble benchmarks for SO_2 as specified in the BREF. For the concentration bubble, there is a significant difference between the various cited ranges; these differences are even larger if the period over which the bubble has to be calculated is accounted for (normally the shorter the period the higher the bubble value should be).

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[52] As there are a considerable number of split views on the achievable ELVs when applying BAT, no BAT-AEL has been fixed and the range of split views presented in the BREF document is referred to as benchmarks.

[53] The bubble concept usually refers to air emissions of SO_2 but can also be applied to NO_x, dust, CO and metals (Ni, V). The bubble concept is a regulatory tool applied in several EU Member States and reflects a “virtual single stack” for the whole refinery. The treatment of process water in the refinery is typically done in a single waste water treatment plant (for technical and economic reasons) and conceptually can be regarded as a similar approach to the “bubble concept” for air (Refineries BREF, 2003).

Table 4.3 Technical working group proposed concentration and load bubble benchmarks for SO_2 (BREF, 2003)

Concentration bubble benchmark (mg SO_2/Nm³ @ 3% O_2)		
Range	**Period**	**Proposed by**
60 – 200	Daily	1 Member State
850	Daily	1 Member State
100 – 600	Monthly	2 Member States
800 – 1,200	Monthly	2 Member States
1,000 - 1,400	Yearly	Industry
Load bubble benchmark (t SO_2/$Mt_{throughput}$)		
Range	**Period**	**Proposed by**
50 - 230	Yearly	1 Member State
50 - 210	Yearly	1 Member State

The following process-specific BAT-AELs are cited in the BREF:

- Combustion sources: 5-20 mg/Nm³ for gaseous fuels and 50-850 mg/Nm³ for liquid fuels[54].
- Catalytic cracker: 10-350 mg/Nm³[55].
- Sulphur recovery unit: 2,000-400 mg/Nm³; corresponding to efficiencies in the range of 99.5-99.9%.

4.4.3 BAT-associated emission levels for NO_x

The BREF document has defined a number of techniques considered to be BAT and having an impact on the emissions of NO_x such as:

- For the catalytic cracker, reduce NO_x emissions to 40-150 mg/Nm³ by means of a suitable combination of:
  - Modification of the design and operation of the regenerator, especially aiming to avoid high temperature spots;

[54] Liquid fuels: One Member State argues that a value of <200 mg/Nm³ is more appropriate while industry sources suggest a value of < 1,700 mg/Nm³ (corresponding to a 1% S content in liquid fuels).

[55] One Member State argues that a range of 10 - 100 mg/Nm³ is more appropriate.

- Hydrotreatment of the feedstock if technically and economically viable;

- Using SNCR on the regenerator flue gas, achieving a NO_x reduction of 60-70%;

- Using SCR on the regenerator flue gas, achieving a NO_x reduction of 85-90%.

• For energy systems:

- By reducing fuel consumptions / energy efficiency;

- Reduce NO_x emissions from boilers and heaters using gaseous fuel to 20-150 mg/Nm³ by a suitable combination of: High thermal efficiency designs with good control systems; low-NO_x burner techniques; flue gas circulation in boilers; reburning technique; SNCR or SCR.

- Reduce NO_x emissions from boilers and heaters using liquid fuel to 50-300 mg/Nm³ by a suitable combination of: fuels with low nitrogen content; low-NO_x burner techniques; flue gas circulation in boilers; reburning technique; SNCR or SCR.

- Reduce NO_x emissions from gas turbines to 20-75 mg/Nm³ @ 15% O_2 by a suitable combination of: Diluent injection; dry low-NO_x combustors; SCR.

The refineries BREF specifies refinery-wide benchmarks (concentration or load bubbles) for NO_x and also specifies process-specific BAT-AELs.

Table 4.4 provides an overview of the concentration and load bubble benchmarks for NO_x as specified in the BREF. For the concentration bubble, there is a significant difference between the various cited ranges; this difference is even larger if the period over which the bubble has to be calculated is accounted for (normally the shorter the period the higher the bubble value should be).

Table 4.4 Technical working group proposed concentration and load bubble benchmarks for NO_x (BREF, 2003)

Concentration bubble benchmark (mg NO_x/Nm³ @ 3% O_2)		
Range	**Period**	**Proposed by**
70 – 150	Daily	1 Member State
200	Daily	1 Member State
100 - 200	Monthly	1 Member State
150	Monthly	1 Member State
250 – 450	Monthly	2 Member States
200 – 500	Yearly	Industry
Load bubble benchmark (t NO_x / $Mt_{throughput}$)		
Range	**Period**	**Proposed by**
20 – 150	Yearly	1 Member State
80 – 170	Daily	1 Member State

The following process-specific BAT-AELs for NO_x are cited in the BREF:

- Boilers and heaters: Gaseous fuel: 20-150 mg/Nm³ [56]; and liquid fuel: 55-300 mg/Nm³ [57];
- Gas turbines: 20-75 mg/Nm³ @ 15% O_2 [58];
- Catalytic cracker: 40-150 mg/Nm³ [59].

4.4.4 BAT-associated emission levels for particulate matter (PM)

The BREF document has defined a number of techniques considered to be BAT and having an impact on the emissions of PM such as:

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[56] Two Member States argue that 100 mg/Nm³ as an upper limit is more appropriate.

[57] One Member State argues that 200 mg/Nm³ for heaters < 50 MW and 100 mg/Nm³ for heaters > 50 MW (+SCR) is more appropriate; another Member State cites values in the range 200 – 400 mg/Nm³.

[58] One Member State argues that 35 mg/Nm³ is an appropriate upper limit for a combination of primary measures and SCR.

[59] Various Member States cite other ranges: < 100 mg/Nm³, 300 – 450 mg/Nm³ and 10 – 450 mg/Nm³.

- Minimising the particulate emissions from solids handling situations by applying good housekeeping and control techniques;

- For the catalytic cracker, reduce particulate emissions to 10-40 mg/Nm^3 (50 mg/Nm^3 can be seen as a more suitable upper limit because of poor reliability of the monitoring system and technical difficulties with upgrading existing ESPs) by means of a suitable combination of:

  - Tertiary and multistage cyclones;

  - Applying an ESP or scrubber to the regenerator gas – BAT range associated efficiencies are 95-99%;

  - Hydrotreatment of the feedstock if technically and economically viable;

  - Selection of attrition resistant catalyst.

- Coking:

  - Collecting and recycling as much as possible within the refinery the coke fines generated in the coking process;

  - Achieve emissions of 10-50 mg/Nm^3 by applying ESP and/or cyclones and/or filters from the different flue gasses containing particles.

- For energy systems, reduce particulate emissions from liquid firing to 5 – 20 mg/Nm^3 by applying a suitable combination of:

  - Reducing fuel consumption;

  - Maximising the use of gas and low ash liquid fuels;

  - Steam atomisation of liquid fuels;

  - Application of ESP or filters to the flue gas when liquid fuel is used.

The BREF document refers to refinery-wide benchmarks (concentration bubbles) for PM:

- Concentration bubble of 30 – 50 mg/Nm^3 on a monthly basis;

- Concentration bubble of 15 – 50 mg/Nm^3 on a yearly basis.

The following process-specific AELs for PM are cited in the BREF:

- Combustion sources: Liquid fuel: 5 – 20 mg/Nm^3 [60]

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[60] One Member State claims the range of 30 – 50 mg/Nm^3 and industry claims the range of 5 – 50 mg/Nm^3 to be more appropriate.

- Catalytic cracker: 10 – 40 mg/Nm^3 [61]
- Coking unit: 10 – 50 mg/Nm^3 [62]

4.4.5 BAT-associated emission levels for NMVOC

The BREF document does not specify refinery-wide benchmarks (concentration or load bubbles) for NMVOCs, nor does it specify process-specific BAT-AELs.

4.4.6 BAT-associated emission levels for discharges to water

An overview of the concentration and load bubble BAT-AEL for discharges to water is provided in the BREF document and is cited in the table below.

[61] 50 mg/Nm^3 is cited to be more appropriate for plants with existing electrostatic precipitators.

[62] Industry claims that an upper limit of 100 mg/Nm^3 is more appropriate.

Table 4.5 Technical working group proposed concentration and load bubble AEL for discharges to water (BREF, 2003)

Concentration bubble AEL (mg/l; monthly average)		
Parameter	**BAT-AEL range**	**Split view**
Total hydrocarbons	0.05 – 1.5	0.05 – 3 (1 Member State) 0.05 – 5 (1 Member State)
BOD	2 – 20	
COD	30 – 125	30 – 75 (1 Member State)
Ammoniacal N	0.25 – 10	0.25 – 5 (1 Member State)
Total N	1.5 – 25	
Suspended solids	2 – 50	2 – 30 (1 Member State)
Total metals	<0.1 - 4	
Load bubble AEL ($g/t_{throughput}$)		
Parameter	**BAT-AEL range**	**Split view**
Total hydrocarbons	0.01 – 0.75	
BOD	0.5 – 11	
COD	3 – 70	3 – 45 (1 Member State)
Ammoniacal N	0.1 – 6	
Total N	0.5 – 15	0.5 – 8 (1 Member State)
Suspended solids	1 - 25	

4.5 Sector wide analysis

4.5.1 Overview

This section provides an overall assessment of the state of implementation of the IPPC Directive in the mineral oil and gas refineries sector. The following analysis is based on publicly available data, mainly:

- Oil & Gas Journal's (OGJ) worldwide refining survey, providing information on individual refineries' nameplate capacity (NPC) and the capacity of the individual process units allowing the determination of the refineries' Nelson Complexity Index (NCI);
- Emission data from the individual refineries reported in the EPER database (for 2001 and 2004);
- Country-wide emission data from refineries as officially reported to within the framework of the Convention on Long Range Transboundary Air Pollution (CEIP emission database);

- Country-wide refinery crude oil throughput as officially reported to Eurostat;
- Publicly available environmental reports from individual companies;
- EU-wide refinery emission data as reported by Concawe;
- Recent (beyond 2004) emission data for 63 individual installations were obtained from:
  - Publicly available environmental reports from individual companies (web search);
  - National emission inventory websites (national registers of ES, FR, NL, SE);
  - Data provided by workshop participants (UK Pollution Inventory detailed data).

European refineries are all existing installations according to the definition of the IPPC Directive (they thus only had to meet the Directive's requirements by 30 October 2007). The focus of the following analysis is primarily on emissions to air and water from the refineries sector, as data regarding other environmental issues such as waste and noise are not generally publicly available.

4.5.2 Permitting progress

Entec (along with IEEP) has assessed the extent of permitting progress for existing installations in 2007 (state of play 2005-2006) and in 2008 (state of play Q1-Q2/2008). Data from both studies indicate that significant progress has been made for the refineries sector in issuing permits in a number of Member States (but by no means all) over the last 2-3 years (as illustrated in the figure below). These data also indicate that bringing the permits in line with the requirements of the IPPC Directive, including imposing BAT-based ELVs, is only likely to have started recently in a number of Member States, in such a way that the effects of permit updating on emissions from the refineries sector may only start to be reflected in very recent emissions monitoring data.

Figure 4.3 Evolution of the extent of permitting progress for the refineries' sector in various Member States over the period 2005/2006 and 2008

	Situation 2005 - 2006							Situation 2008						
	Existing installations	New permit	Reconsidered Not updated	Reconsidered Updated	In line	Outstanding	Completion	Existing installations	New permit	Reconsidered Not updated	Reconsidered Updated	In line	Outstanding	Completion
AT	1					1	0%	1			1	1		**100%**
BE	9	9			9		100%	8	13	1		14		100%
BU								4	3			3	1	75%
CY														
CZ	11	6			6	5	55%	10	6			6		**100%**
DK	9	1		8	9		100%							
EE	3					3	0%	3	1			1	2	**33%**
FI	2					2	0%	2	2			2		**100%**
FR	14					14	0%	19	0	15	4	19		**100%**
DE	100	24	24	36	84	27	76%	91	30	20	85	135	7	**95%**
EL	4					4	0%	4	2			2	2	**50%**
HU	2	2			2		100%	3	3			3		100%
IE	1			1	1		100%	1			1	1		100%
IT								17					17	0%
LV														
LT	1			1	1		100%	1	1			1		100%
LU														
MT														
NL	6	4			4	2	67%	4	12	10		22	7	**76%**
PL	10	2			2		100%	12	9			9	3	**75%**
PT	2					2	0%	2	2			2		**100%**
RO								9	1		8	9		100%
SK								13	13			13		100%
SI														
ES	9					2	0%	11	6			6	5	**55%**
SE								5	2	2		4	1	80%
UK	112	11	0		11		100%	35	35			35		100%
Total	296	59	24	46	129	62	68%	255	141	48	99	288	45	**86%**

4.5.3 Emissions to air – SO_2

Emission sources for SO_2

The main sources of SO_2 emissions in a refinery are the combustion of fuels (furnaces and combustion plants), the catalytic cracker (FCC) and the sulphur recovery unit (SRU). SO_2 emissions from combustion sources are mainly determined by the S-content of the fuel and whether or not end-of-pipe measures for SO_2 are incorporated. In general, liquid fuels have a higher S-content than gaseous fuels, though in the case of refineries the degree of desulphurisation of the refinery gas (light gaseous fraction produced in various process units of the refinery) also plays an important role. SO_2 emissions from the catalytic cracker are mainly determined by feedstock S-content (whether desulphurised or not) and the presence of end-of-pipe measures for SO_2 abatement. SO_2 emissions from the sulphur recovery unit are mainly determined by the type of unit and the presence of aftertreatment to further remove SO_2 from the treated gases.

The most important factor affecting the SO_2 emissions from a refinery is the S-content of the crude oil, because this affects all other S-sources:

- High S-content of the crude oil generally leads to higher S-contents in fuel oil and in catalytic cracker feedstock;
- In the case of desulphurisation of fuels and feedstock, a significant amount of H_2S passes to the refinery gas either leading to high SO_2 emissions from this source or imposing the need for H_2S removal and
- H_2S removed from the refinery gas is treated in the SRU, with large quantities of H_2S leading to high total emissions from the SRU.

Another important factor is the refineries' complexity. In general, the more complex a refinery is, the higher the need for thermal energy for the various process units will be, requiring higher fuel consumption and hence resulting in higher SO_2 emissions.

In the following section, it will only be possible to assess the load bubble against the BREF benchmarks, because most of the time data are lacking on the emissions from the individual process units.

Long term evolution of SO_2 emissions in the refineries sector in Europe

Based on information collected in an annual survey by Concawe on EU-wide refinery SO_2 emissions (see more detailed information in Appendix G), it is evident that there has been a gradual decrease over the period 1978-2002 of average crude S-content and a steep increase of sulphur recovered, leading to a gradual decrease of the EU average bubble SO_2 load. The EU average bubble load is, however, still about double that of the BREF load bubble benchmarks, having upper limits ranging from 210-230 tonne/Mtonne throughput.

It is clear, however, that crude S-content is not the sole variable determining the SO_2 concentration bubble. While average S-content in crude to the refineries in the Northwest region (Belgium, The Netherlands, Germany, Denmark) is higher than that in crude to the Atlantic refineries (UK, Ireland, Portugal and refineries located on the Atlantic coasts of France and Spain), the SO_2 concentration bubble of Northwest refineries is significantly lower. It is also clear that refineries from the Atlantic and Mediterranean regions on average have concentration bubbles which are higher than the BREF concentration bubble benchmarks.

Analysis of the EPER data for SO_2

As data concerning individual refinery throughput were not available, the load bubble based on information from the EPER database was calculated based on the refineries' nameplate capacity (NPC). As utilisation factors have generally been between 90% and 95% over the last few years, the calculated value of the load bubble is slightly overestimated.

The EPER database distinguishes between measured (M), calculated (C) and estimated (E) emission data:

- Code M: emission data are based on measurements using standardised or accepted methods; often additional calculations are needed to convert the results of measurements into annual emission data.
- Code C: emission data are based on calculations using nationally or internationally agreed estimation methods and emission factors, which are representative for the industrial sectors and
- Code E: emission data are based on non-standardised estimations derived from best assumptions or expert guesses.

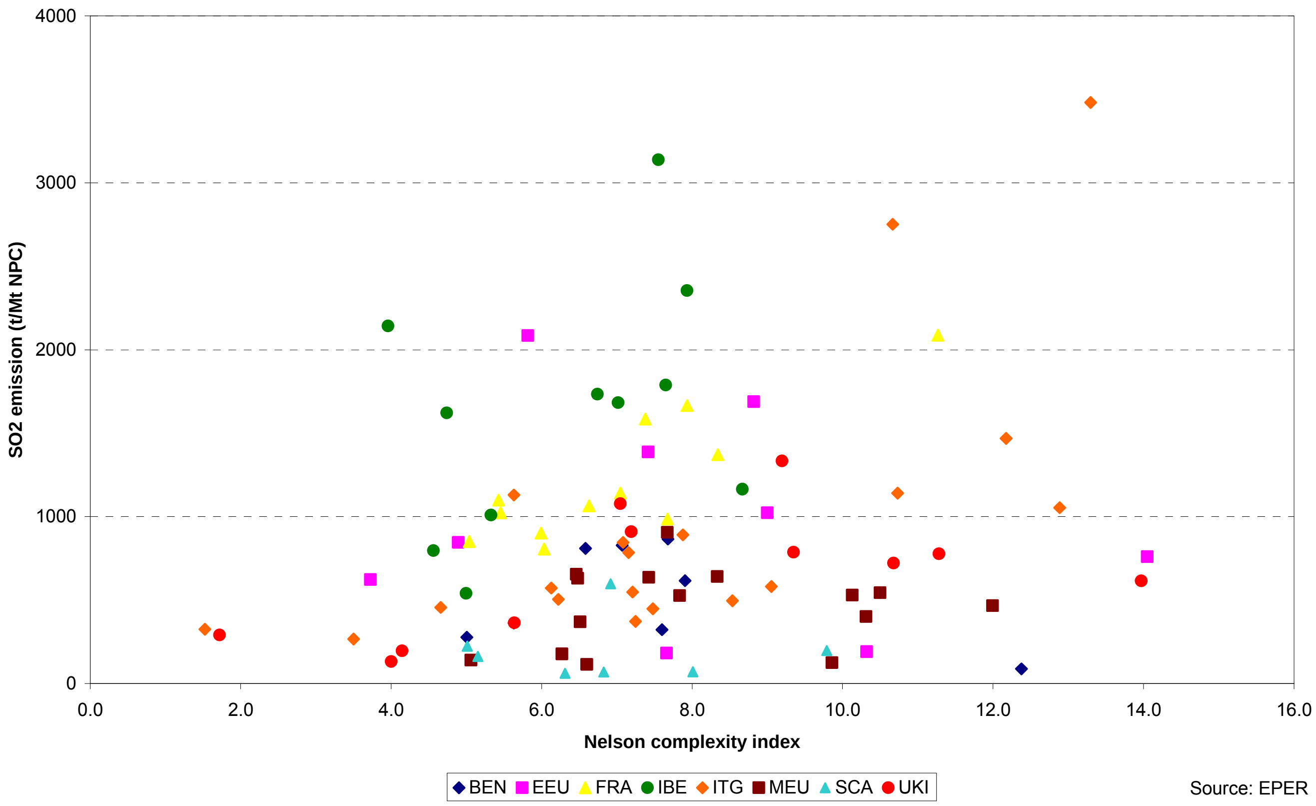
These codes do not refer to the accuracy of the emission data, because there is no uniform relationship between the method used and the accuracy of the resulting emission figure. Appendix G provides an overview of the share of M, C and E values for SO_2 emission data for the 2004 EPER data for the individual Member States.

Figure 4.4 shows the calculated 2004 load bubble as a function of the Nelson complexity index for the various regions in Europe. From this figure, it is apparent that only a few (17% or 15 out of 91) refineries in the EU met the load bubble benchmark set out in Section 4.4 of this report. For refineries in the regions BEN, MEU and SCA, the SO_2 load bubble is independent of the refineries' complexity, while for refineries in the regions FRA, ITG and IBE the SO_2 load bubble strongly increases with refinery complexity. This suggests that measures can be taken to control SO_2 emissions even if the number of process units increases.

Based on the EPER data for 2001 and 2004, only taking into account refineries that provide data for both years, the SO_2 load bubble has decreased in most regions, indicating the implementation of measures for reduction of SO_2 emissions (Table 4.6). From this table, the large difference between the average SO_2 load bubble for the various regions is also obvious, with some regions having an average SO_2 load bubble that is 5 to 8 times higher than the SO_2 load bubble in other regions.

As the codes M, C and E, used in EPER, do not provide information on the accuracy of the emission data, no judgement can be readily made on the accuracy of the emission data. This accuracy will be determined by the scrutiny of the emission inventory exercise at the individual company level on the one hand and on whether an independent validation of these emission data (for example, by competent authorities or certification companies) has taken place. It should be recognised, however, that variability in emissions estimation approaches amongst refineries and also changes in approaches over time for individual refineries will introduce uncertainties in the data (in terms of comparability and accuracy).

Figure 4.4 SO_2 load bubble (based on NPC) as a function of Nelson complexity index in 2004



Source: EPER

Table 4.6 Evolution of the region average SO_2 load bubble over the period 2001-2004

Region	Region average SO_2 load bubble (tonne/Mtonne$_{NPC}$)	
	2001	2004
BEN	601.2	520.9
EEU	No data	970.5
FRA	1310.1	1215.1
IBE	2378.3	1633.8
ITG	1058.6	953.4
MEU	587.2	457.8
SCA	211.6	197.7
UKI	641.8	655

Regions are as described in Section 4.3.2 of this report.

Analysis of recent individual refinery data for SO_2

The following discussion provides information on refinery load bubbles for the various Member States, as well as country-level load bubbles. The data supporting the information below have been taken from publicly available sources. They are intended to provide an *indication* of progress in changing emissions but are not based on detailed installation-level data and data have not been cross-checked with the Member States and installations concerned.

Yearly total SO_2 emissions from 63 individual refineries for the year 2006 (2007 for the UK and Ireland refineries) have been collected from publicly available data. Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Figure 4.5 shows the calculated 2006 SO_2 load bubble as a function of the Nelson complexity index for the various regions in Europe. From this figure, it is clear that no significant progress in reducing emissions is evident. Only a few (9.5% or 6 out of 63) refineries in the EU met the load bubble benchmark, which is the same number as in 2004 when only the 63 refineries for which 2006 emission data are available are considered. 38 out of 63 individual refineries have a lower SO_2 load bubble in 2006 compared to the situation in 2004, while the remaining 25 refineries have a higher SO_2 load bubble in 2006. There are uncertainties in the underlying data and information from one year for a refinery may not be directly comparable with data for another year due to the data collection / emission estimation methods used.

Evolution of the percentage change in SO_2 load bubble over the period 2004-2006 for the individual refineries is illustrated in Appendix G. It is apparent from these data that the majority of the refineries in the regions FRA, ITG and SCA have made progress in reducing SO_2 emissions.

Considering the percentage of refineries that meet the load bubble benchmarks for SO_2, based on the individual refinery data for 2004 and 2006 (there is a different number of refineries in each dataset), SCA was the only region where over 50% of the refineries met the SO_2 load bubble benchmark. In the regions BEN, EEU, MEU and UKI a limited number of refineries met the SO_2 load bubble benchmarks, while for the regions FRA, IIBE and ITG, none of the refineries met the SO_2 load bubble benchmark (Table 4.7).

Figure 4.5 SO_2 load bubble (based on NPC) as a function of Nelson complexity index in 2006

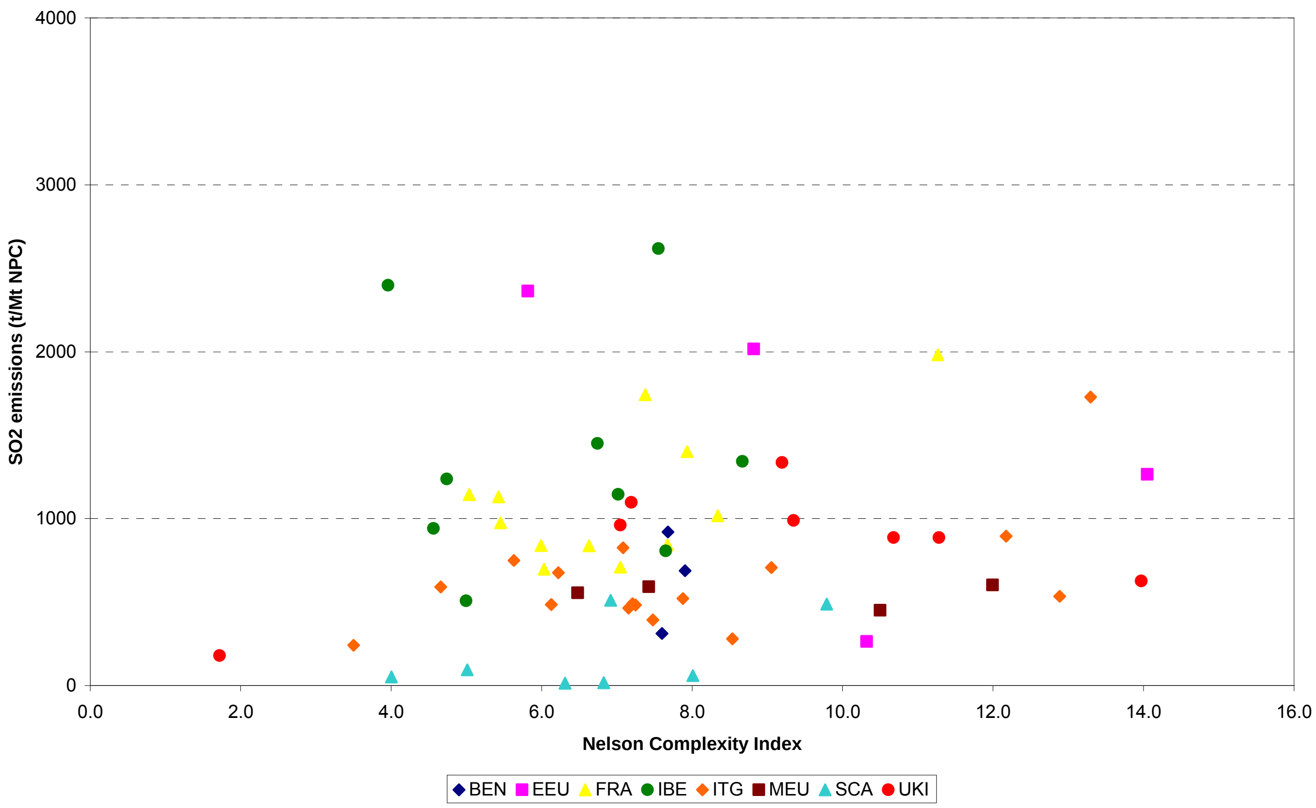


Table 4.7 Percentage of refineries within each region that meet the SO_2 load bubble benchmark – based on individual refinery data for 2004 and 2006

Region	2004 dataset	2006 dataset
BEN	13% (1 out of 8)	0% (0 out of 3)
EEU	25% (2 out of 8)	0% (0 out of 4)
FRA	0% (0 out of 12)	0% (0 out of 12)
IBE	0% (0 out of 11)	0% (0 out of 9)
ITG	0% (0 out of 19)	0% (0 out of 16)
MEU	27% (4 out of 15)	0% (0 out of 4)
SCA	86% (6 out of 7)	71% (5 out of 7)
UKI	18% (2 out of 11)	13% (1 out of 8)

Regions are as described in Section 4.3.2 of this report.

Evolution of country-wide load bubbles for SO_2

The combination of the country-wide SO_2 emission data from refineries as officially reported within the framework of the Convention on Long Range Transboundary Air Pollution (CEIP emission database) and the country-wide refinery crude oil throughput as officially reported to Eurostat allows for the calculation of country-wide load bubbles. These have been calculated for the period 1996 (adoption date of the IPPC Directive) to 2006 (the most recent year for which data are available). This evolution is shown in Appendix G compared to BREF load bubble benchmarks.

The country-wide load bubble for SO_2 is within the range of or below the lower end of the BREF load bubble benchmark for the Czech Republic (2006), Denmark, Sweden and Finland only. For some of the best performing Member States (Denmark, Sweden) further reductions in emissions of SO_2 have been realised over the 10 year period. The country-wide load bubble has decreased in the 1990s for Belgium, The Netherlands and Germany, but remained largely unchanged over the 5-6 years to 2006. For the Southern European Member States (France, Spain, Italy, Portugal and Bulgaria) the SO_2 load bubble decreased over the period 1996-2006. In some Member States (Ireland, UK and Lithuania) there has been a recent apparent increase in the SO_2 load bubble based on these data. Again, the aforementioned uncertainties in these data should be taken into account.

A wide variation in country wide SO_2 load bubbles for the most recent year for which data are available (2006) is obvious from the data presented in Table 4.8. Based on these data, it appears that only the country-wide average load bubble of the Scandinavian countries (DK, FI and SE) and of CZ are in line with the BREF load bubble benchmark for SO_2. The highest country-wide average SO_2 load bubble benchmarks are found for PL, ES, PT, GR, LT and BG.

Table 4.8 Evolution of country-wide SO_2 load bubbles (t/$Mt_{throughput}$) for the individual Member States over the period 2001-2006

Region	Member State	Country wide average SO_2 load bubble (tonne/$Mtonne_{throughput}$)		
		2001	2004	2006
BEN	BE	691	733	745
	NL	452	520	417
EEU	CZ	521	484	***111***
	PL	1,514	1,843	1,593
FRA	FR	950	795	647
IBE	ES	1,701	1,212	1,061
	PT	2,210	1,636	1,477
ITG	CY	848	1,147	
	GR		1,865	2,333
	IT	855	787	582
MEU	AT	409	449	431
	DE	480	441	467
SCA	DK	***75***	***52***	***51***
	FI	239	267	***133***
	LT		832	1,436
	SE	***42***	***35***	***28***
UKI	IE	***140***	232	330
	UK	934	840	976
BG	BG	4,765	3,653	1,354

Underlined text = Country wide average SO_2 load bubble within range of the BREF load bubble benchmark.
Regions are as described in Section 4.3.2 of this report.

4.5.4 Emissions to air – NO_x

Emission sources for NO_x

The main sources of NO_x emissions in a refinery are the combustion of fuels (furnaces and combustion plants) and the catalytic cracker (FCC). NO_x emissions from combustion sources are mainly determined by combustion conditions (thermal NO_x emissions) and whether or not process integrated or end-of-pipe measures for NO_x are incorporated. There are also emissions of NO_x that occur from the N-content of fuels (fuel NO_x) though these are generally less significant.

In the following sections, it has only been possible to assess the load bubble against the BREF benchmarks, because data are lacking on the emissions from the individual process units.

It also has to be stressed that the error in the determination of NO_x emissions is higher than in the determination of SO_2 emissions. While SO_2 emissions are readily obtained from a sulphur balance over the refinery, sometimes in combination with monitoring data, NO_x emissions have to be determined by monitoring. The error on the annual load obtained from the monitoring data will largely depend on whether monitoring is continuous or based on spot samples and on the methodology used to extrapolate to yearly emissions from spot sample data.

Analysis of the EPER data for NO_x

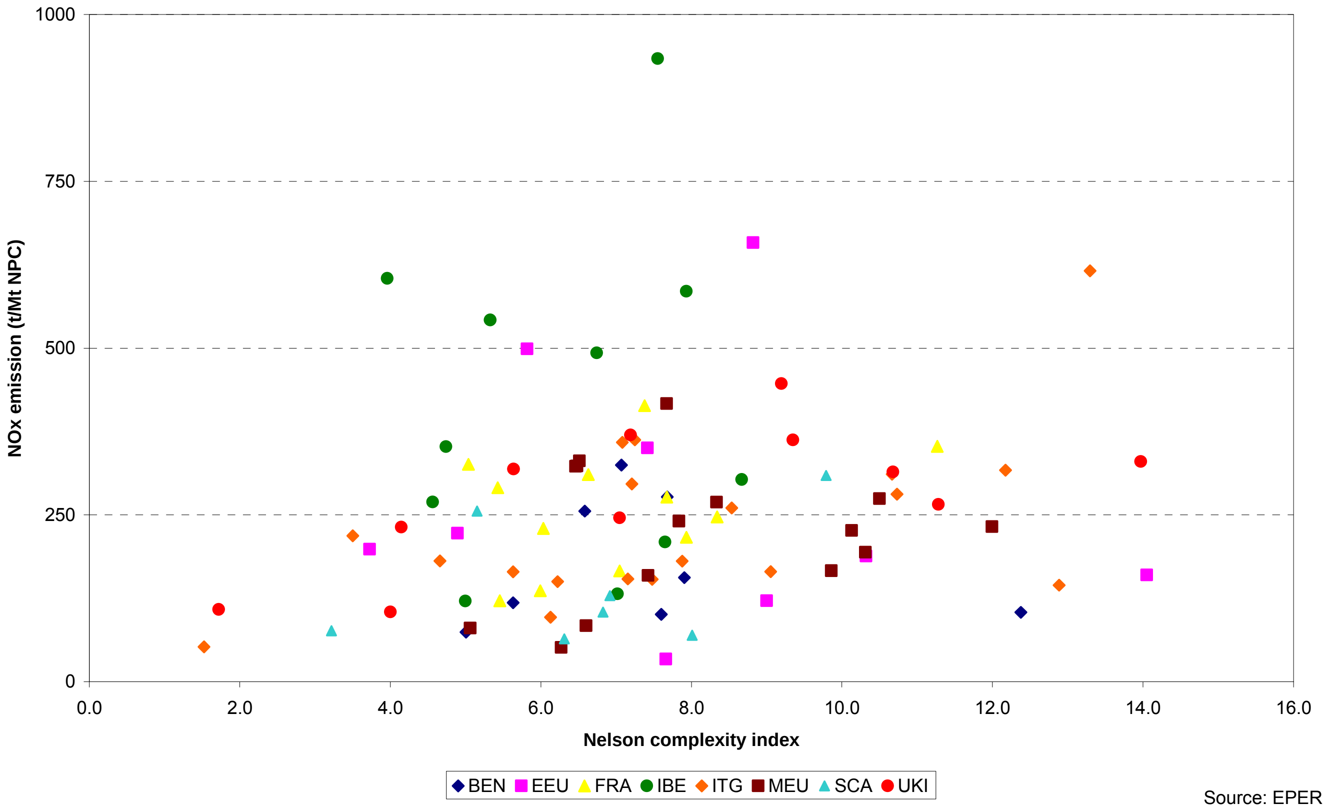
Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Figure 4.6 shows the calculated 2004 load bubble as a function of the Nelson complexity index for the various regions in Europe. From this figure, about 33% (30 out of 91) of the refineries in the EU met the load bubble benchmark (as set out in Section 4.4 of this report).

Based on the EPER data for 2001 and 2004, the NO_x load bubble did not vary significantly in any region, suggesting that few NO_x reducing measures were implemented over that period (Table 4.9).

The load bubble is independent of the refineries' complexity, with all regions having some refineries that met the BAT-based load bubble and some refineries that did not. However, some regions have average load bubbles that are half to a third of the load bubble of other regions.

Figure 4.6 NO$_x$ load bubble (based on NPC) as a function of Nelson complexity index in 2004



Source: EPER

Table 4.9 Evolution of the regional average NO$_x$ load bubble over the period 2001-2004

Region	Region average NO$_x$ load bubble (tonne/Mtonne$_{NPC}$)	
	2001	2004
BEN	176.1	176.4
EEU	No data	288.9
FRA	254	257.3
IBE	398.4	413.3
ITG	256.6	235
MEU	233	224.8
SCA	127.8	144.1
UKI	281.4	281.7

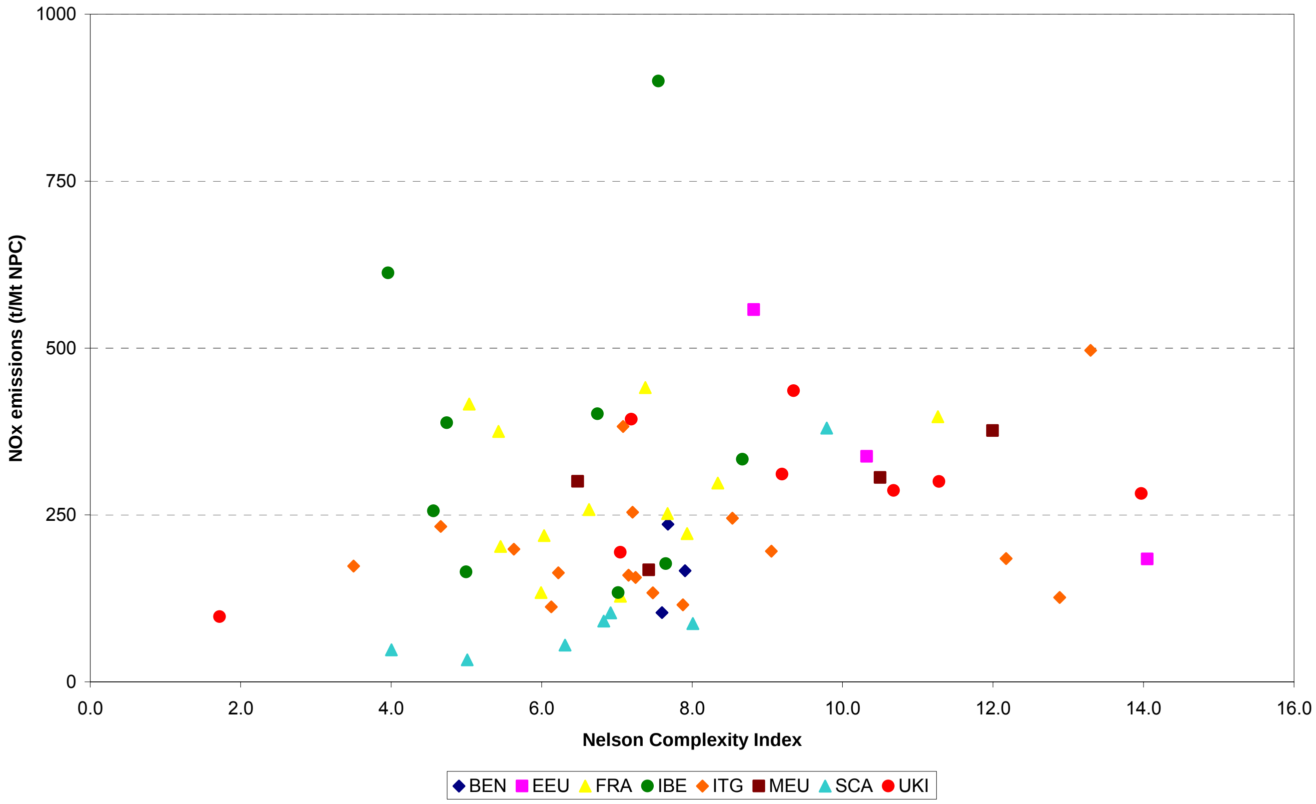
Regions are as described in Section 4.3.2 of this report.

Analysis of recent individual refinery data for NO_x

Yearly total NO_x emissions from 62 individual refineries for the year 2006 (2007 for the UK and Ireland refineries) have been collected from publicly available data. Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Figure 4.7 shows the calculated 2006 NO_x load bubble as a function of the Nelson complexity index for the various regions in Europe. In 2006, some 23 out of 62 individual refineries met the upper load bubble benchmark of 230 tonne/Mtonne, while in 2004 only 21 of the 62 individual refineries for which 2006 emission data are available met the upper load bubble benchmark, suggesting that some progress has been made in reducing NO_x emissions.

Figure 4.7 NO_x load bubble (based on NPC) as a function of Nelson complexity index in 2006



29 out of 62 individual refineries had a lower NO_x load bubble in 2006 compared to the situation in 2004, while the remaining 23 refineries had a higher NO_x load bubble in 2006. Evolution of the percentage change in NO_x load bubble over the period 2004-2006 for the individual refineries is illustrated in Appendix G. From this figure it appears that the majority of the refineries in the regions FRA, ITG and SCA have made progress in reducing NO_x emissions.

Considering the percentage of refineries that met the load bubble benchmarks for NO_x, based on the individual refinery data for 2004 and 2006 (there is a different number of refineries in each dataset), the regions where over 50% of the refineries met the NO_x load bubble benchmark were BEN and SCA. In all other regions, only a limited number of refineries met the NO_x load bubble benchmark (Table 4.10).

Table 4.10 % of refineries within each region that meet the NO_x load bubble benchmark – based on individual refinery data for 2004 and 2006

Region	2004 dataset	2006 dataset
BEN	63% (5 out of 8)	67% (2 out of 3)
EEU	25% (2 out of 8)	0% (0 out of 3)
FRA	17% (2 out of 12)	17% (2 out of 12)
IBE	18% (2 out of 11)	22% (2 out of 9)
ITG	42% (8 out of 19)	44% (7 out of 16)
MEU	33% (5 out of 15)	25% (1 out of 4)
SCA	71% (5 out of 7)	86% (6 out of 7)
UKI	18% (2 out of 11)	13% (1 out of 8)

Regions are as described in Section 4.3.2 of this report.

Evolution of country-wide load bubbles for NO_x

The combination of the country-wide NO_x emission data from refineries as officially reported within the framework of the Convention on Long Range Transboundary Air Pollution (CEIP emission database) and the country-wide refinery crude oil throughput as officially reported to Eurostat allows for the calculation of country-wide load bubbles. These have been calculated for the period 1996 (year of adoption of the IPPC Directive) until 2006 (the most recent year for which data are available). This evolution is shown in Appendix G for the different countries, along with BREF load bubble benchmarks and is summarised in the table below.

The country-wide load bubble for NO_x is within the range of or below the lower end of the BREF load bubble benchmark for The Netherlands, Sweden and the Czech Republic only. The country-wide load bubble for NO_x has decreased over the period 1996-2006 for The Netherlands, Germany, Spain, Italy, Denmark, Lithuania, Finland, Bulgaria and the Czech Republic. A wide variation in country-wide NO_x load bubbles for the most recent year (2006) is obvious from the data presented in Appendix G. The country-wide average load bubbles are only in line with the BREF load bubble benchmark for NO_x for NL, CZ and SE. The highest country-wide average SO_2 load bubble benchmarks are found for PL, ES and PT.

Table 4.11 Evolution of the country-wide NO_x load bubbles ($t/Mt_{throughput}$) for the individual Member States over the period 2001 – 2006

Region	Member State	Country-wide average NO_x load bubble ($tonne/Mtonne_{throughput}$)		
		2001	2004	2006
BEN	BE	210	197	183
	NL	***159***	***151***	***146***
EEU	CZ	388	***114***	***74***
	PL	514	453	414
FRA	FR	233	199	232
IBE	ES	459	431	409
	PT	492	513	502
ITG	CY	173	***143***	
	GR		278	348
	IT	305	262	243
MEU	AT	373	403	396
	DE	193	183	189
SCA	DK	231	200	172
	FI	259	191	188
	LT		326	312
	SE	***85***	***74***	***70***
UKI	IE	257	274	260
	UK	359	357	365
BG	BG	673	580	350

Underlined text = Country wide average NO_x load bubble within range of BREF load bubble benchmark
Regions are as described in Section 4.3.2 of this report.

4.5.5 Emissions to air – particulate matter

Emission sources for particulate matter

The main sources of PM emissions in a refinery are the combustion of liquid fuels (furnaces and combustion plants), the catalytic cracker (FCC) and, in some refineries, the coking unit. PM emissions from combustion sources are mainly determined by the ash content of the liquid fuel, the quality of the combustion (soot formation) and whether or not end-of-pipe measures for PM are incorporated. The ash content of the liquid fuel largely depends on fuel type (heavy versus light fuel oil) and the degree of desulphurisation (desulphurisation also removes

part of the metal content of the fuel). PM emissions from the catalytic cracker are mainly determined by catalyst type (abrasion resistance) and the presence of end-of-pipe measures for PM abatement. PM emissions from coking units are entirely dependent on the presence of end-of-pipe measures.

The number of European refineries with a coking plant is relatively small.

The error in the determination of the PM emissions will be higher than in the determination of the SO_2 and NO_x emissions because PM emissions have to be determined solely by monitoring. The error on the annual load obtained from the monitoring data will largely depend on whether monitoring is continuous or not and on whether all sources have been accounted for.

Analysis of the EPER data for particulate matter

Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

The number of refineries reporting emissions of PM in EPER for the year 2004 amounts to only 35, while 91 refineries report emissions of SO_2 and NO_x. The reason for this may be that most refineries do not have PM emissions exceeding the reporting ceiling of 50 tonnes/year.

Appendix G provides an overview of the share of M, C and E values for PM_{10} emission data for the 2004 EPER data for the individual Member States (see the above section on SO_2 for further details).

Figure 4.8 shows the calculated 2004 load bubble as a function of the Nelson complexity index for the various regions in Europe. As no load bubble for PM emissions is derived in the BREF, no comparison can be made. Most refineries have a load bubble in the range of 0-30 tonne/$Mtonne_{NPC}$.

Based on the EPER data for 2001 and 2004, the PM load bubble decreased significantly in some regions, while remaining constant in other regions (Table 4.12). The reasons for this decrease can be twofold:

- On the one hand, it is possible that some refineries have implemented measures for reduction of PM emissions. It is not unlikely that some refineries have switched to gaseous fuels or started to use more desulphurised liquid fuels, which also have a lower ash content. This hypothesis is also supported by the observed decrease of the SO_2 load bubble in certain regions. There has also been a tendency to install end-of-pipe measures for PM on catalytic crackers over recent years and

- On the other hand, it is also possible that a number of refineries were using emission factors to estimate PM emissions for the 2001 EPER reporting and switched to monitoring for estimation of the 2004 emissions.

The load bubble is independent of the refineries complexity. However, some regions have average load bubbles that are up to six times as high as the load bubble of other regions.

Figure 4.8 PM load bubble (based on NPC) as a function of Nelson complexity index in 2004

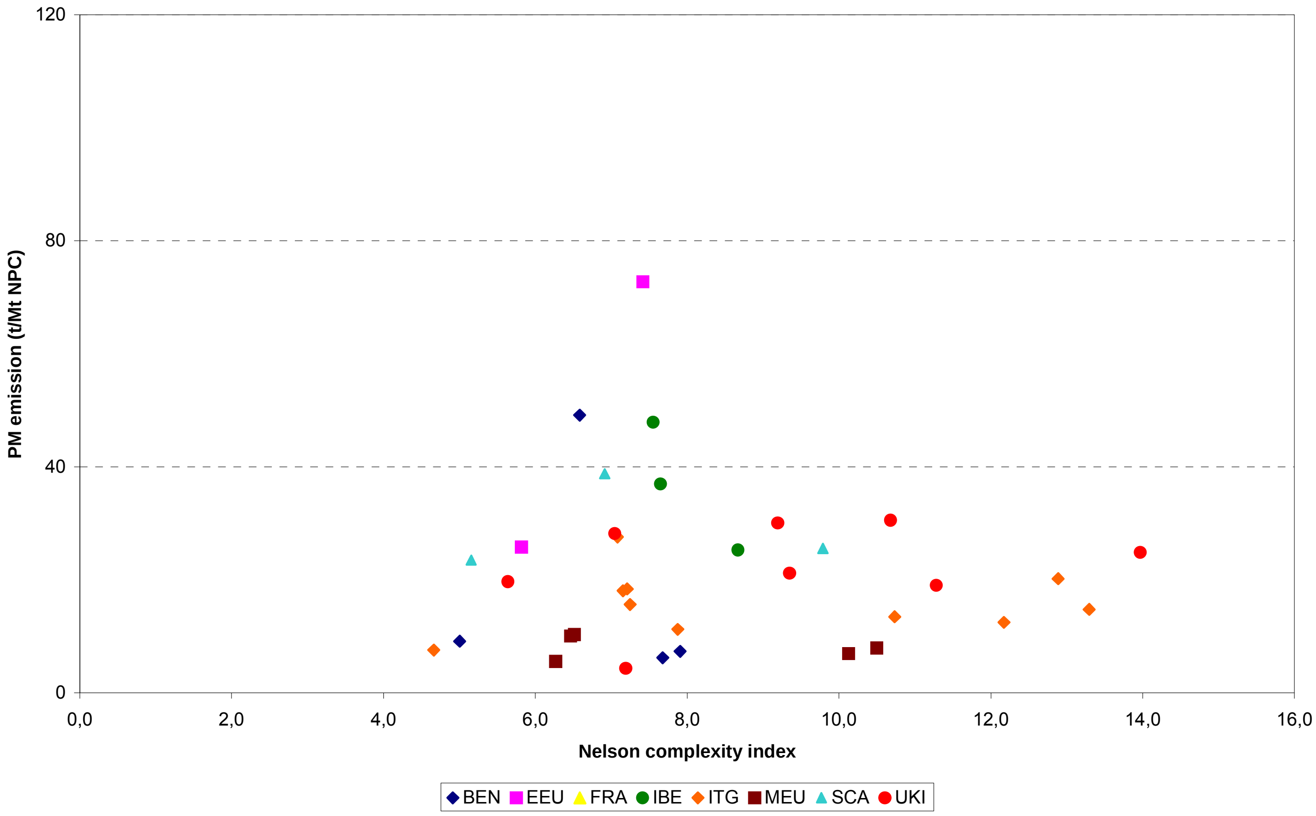


Table 4.12 Evolution of the region average PM load bubble over the period 2001-2004

Region	Region average PM load bubble (tonne/Mtonne$_{NPC}$)	
	2001	2004
BEN	53.5	18
EEU	No data	49.3
FRA	No data	No data
IBE	33.9	36.7
ITG	21.8	16
MEU	15.1	8.2
SCA	41.5	29.3
UKI	23.4	22.2

Regions are as described in Section 4.3.2 of this report.

Analysis of recent individual refinery data for particulate matter

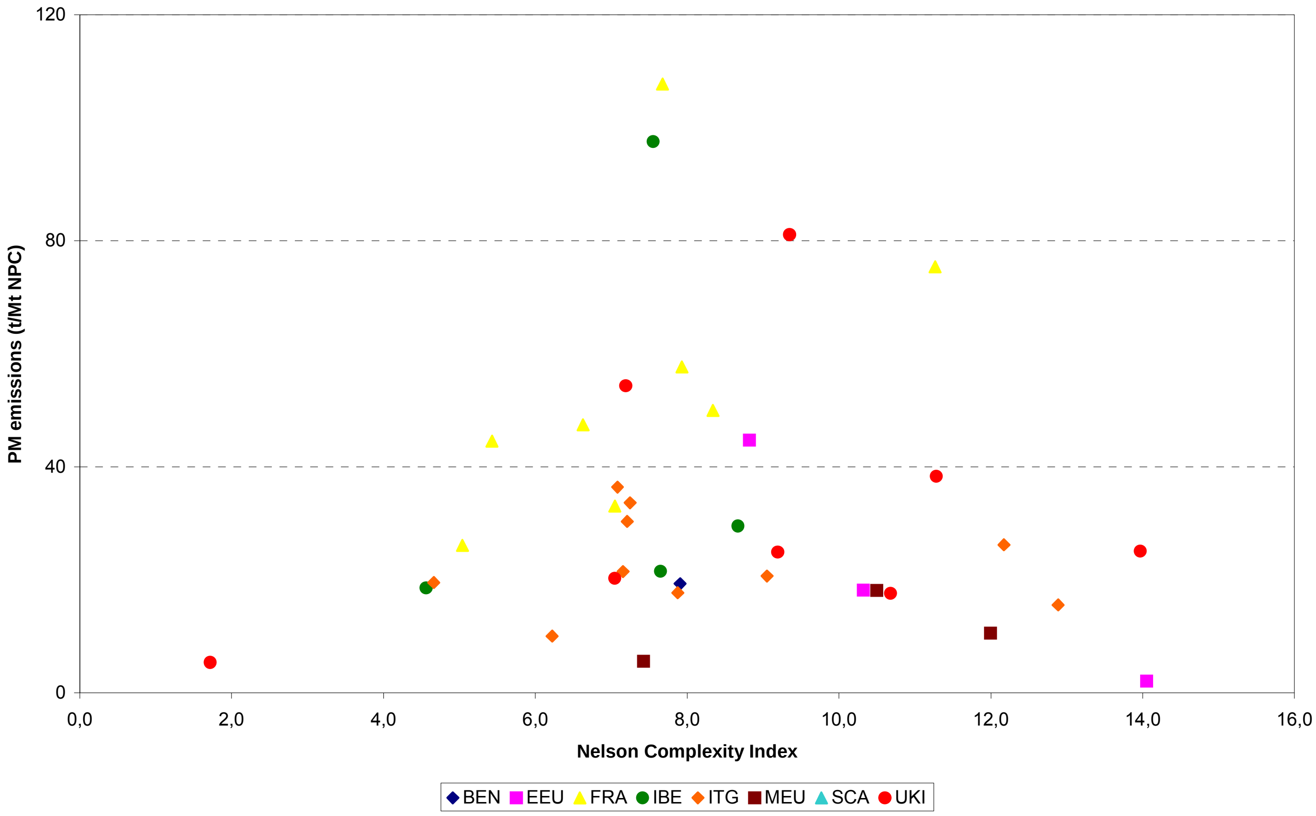
Yearly total PM emissions from 37 individual refineries for the year 2006 (2007 for the UK and Ireland refineries) have been collected from publicly available data. Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Figure 4.9 shows the calculated 2006 PM load bubble as a function of the Nelson complexity index for the various regions in Europe.

Data for both 2004 and 2006 are available for 20 individual refineries. Five of these 20 individual refineries have a lower PM load bubble in 2006 compared to the situation in 2004, while the remaining 15 refineries have a higher PM load bubble in 2006. Evolution of the percentage change in PM load bubble over the period 2004-2006 for the individual refineries is illustrated in Appendix G.

The data for some of the individual installations show an apparent major increase in PM emissions over the period 2004-2006. As mentioned above, this can most likely be ascribed to the increased use of monitoring to assess PM emissions over recent years. In the past, PM emissions from certain sources/stacks were either not accounted for (thought to be insignificant) or have been calculated using emission factors or correlations. The switching from point sampling to continuous monitoring in some cases also leads to an increase of the total (measured) PM emissions; this also applies to the other pollutants.

Figure 4.9 PM load bubble (based on NPC) as a function of Nelson complexity index in 2006



Evolution of country-wide load bubbles for particulate matter

The combination of the country-wide PM_{10} emission data from refineries as officially reported within the framework of the Convention on Long Range Transboundary Air Pollution (CEIP emission database) and the country-wide refinery crude oil throughput as officially reported to Eurostat allows for the calculation of country-wide load bubbles. These have been calculated for the period 1996 (year of adoption of the IPPC Directive) until 2006 (the most recent year for which data are available). This evolution is shown in Appendix G for the different countries. For some Member States, the CEIP emission database does not contain data for all years, explaining the gaps that might appear in some of the figures.

The country-wide load bubble for PM_{10} has decreased over the period 1996-2006 for the UK, Germany, Portugal, Spain, Italy, France, Denmark, Poland and the Czech Republic. A wide variation in country-wide PM_{10} load bubbles for the most recent year (2006) is obvious from the data presented in Table 4.13.

Table 4.13 Evolution of the country-wide PM_{10} load bubbles ($t/Mt_{throughput}$) for the individual Member States over the period 2001 – 2006

Region	Member State	Country wide average PM10 load bubble ($tonne/Mtonne_{throughput}$)		
		2001	2004	2006
BEN	BE	36.2	42.1	24.0
	NL	20.2		26.2
EEU	CZ	13.3	5.8	4.4
	PL	50.4	45.9	29.5
FRA	FR	40.0	33.0	31.3
IBE	ES	60.9	51.1	41.1
	PT	127.9	96.3	88.2
ITG	CY	8.7	35.8	
	IT	34.9	15.7	15.4
MEU	AT	12.8	12.7	11.0
	DE	13.8	13.4	14.4
SCA	DK	17.1	15.1	13.5
	FI	23.3	10.1	12.9
	SE	56.3	52.6	55.1
UKI	IE	18.6	17.3	23.9
	UK	28.0	23.1	22.5

Regions are as described in Section 4.3.2 of this report.

4.5.6 Emissions to air – NMVOC

Emission sources for NMVOC

The main sources of NMVOC emissions in a refinery are the storage, loading and unloading of crude oil and processed fuels and also diffuse emissions. Diffuse emissions either result from equipment leaks at flanges, valves, sample ports, pumps, compressors, etc. or from evaporation of hydrocarbons from API separators, flotation units, wastewater treatment plants, etc.

Emissions of NMVOCs from storage can be abated by the use of external or internal floating roofs or by connecting fixed roof storage tanks to a vapour recovery or vapour incineration unit. Emissions of NMVOCs from loading and unloading can be abated by using vapour return systems or vapour recovery or incineration units. Diffuse emissions from equipment leaks are determined by the equipment itself and can be abated by means of leak detection and repair. Evaporative losses can be controlled by covering certain installations, sometimes in combination with ventilation and vapour destruction.

The error in the determination of the NMVOC emissions will be higher than in the determination of the SO_2 and NO_x emissions because NMVOC emissions are often estimated by the use of correlations, sometimes in combination with monitoring (leak detection and repair). Experience in Sweden, as indicated at the workshop undertaken for this study, has shown that monitoring of NMVOC emissions from a distance with e.g. infrared techniques might yield significantly higher emissions than the estimates calculated by correlations.

Analysis of the EPER data for NMVOC

Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Appendix G provides an overview of the share of M, C and E values for NMVOC emission data for the 2004 EPER data for the individual Member States (see the above section on SO_2 for further details).

Figure 4.10 shows the calculated 2004 load bubble as a function of the Nelson complexity index for the various regions in Europe. As no load bubble for NMVOC emissions is derived in the BREF, no comparison can be made. The range of observed load bubbles is very broad, ranging from 20-800 tonne/$Mtonne_{NPC}$. One reason for these observed broad ranges might be the uncertainty in the determination of NMVOC emissions. Another reason might be that, in some refineries, certain activities fall within the permit of another legal entity, such as those for storage and distribution of processed fuels.

Based on the EPER data for 2001 and 2004, the NMVOC load bubble shows no evident trends for any of the regions (Table 4.14). The load bubble is independent of the refineries' complexity. However, some regions have average load bubbles that are up to four times as high as the load bubble of other regions.

Analysis of recent individual refinery data for NMVOC

Yearly total NMVOC emissions from 58 individual refineries for the year 2006 (2007 for the UK and Ireland refineries) have been collected from publicly available data. Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Figure 4.9 shows the calculated 2006 NMVOC load bubble as a function of the Nelson complexity index for the various regions in Europe.

Data for both 2004 and 2006 are available for 51 individual refineries. 28 out of these 51 individual refineries had a lower NMVOC load bubble in 2006 compared to the situation in 2004, while the remaining 23 refineries had a higher NMVOC load bubble in 2006. Evolution of the percentage change in the NMVOC load bubble over the period 2004-2006 for the individual refineries is illustrated in Appendix G.

Figure 4.10 NMVOC load bubble (based on NPC) as a function of Nelson complexity index in 2004

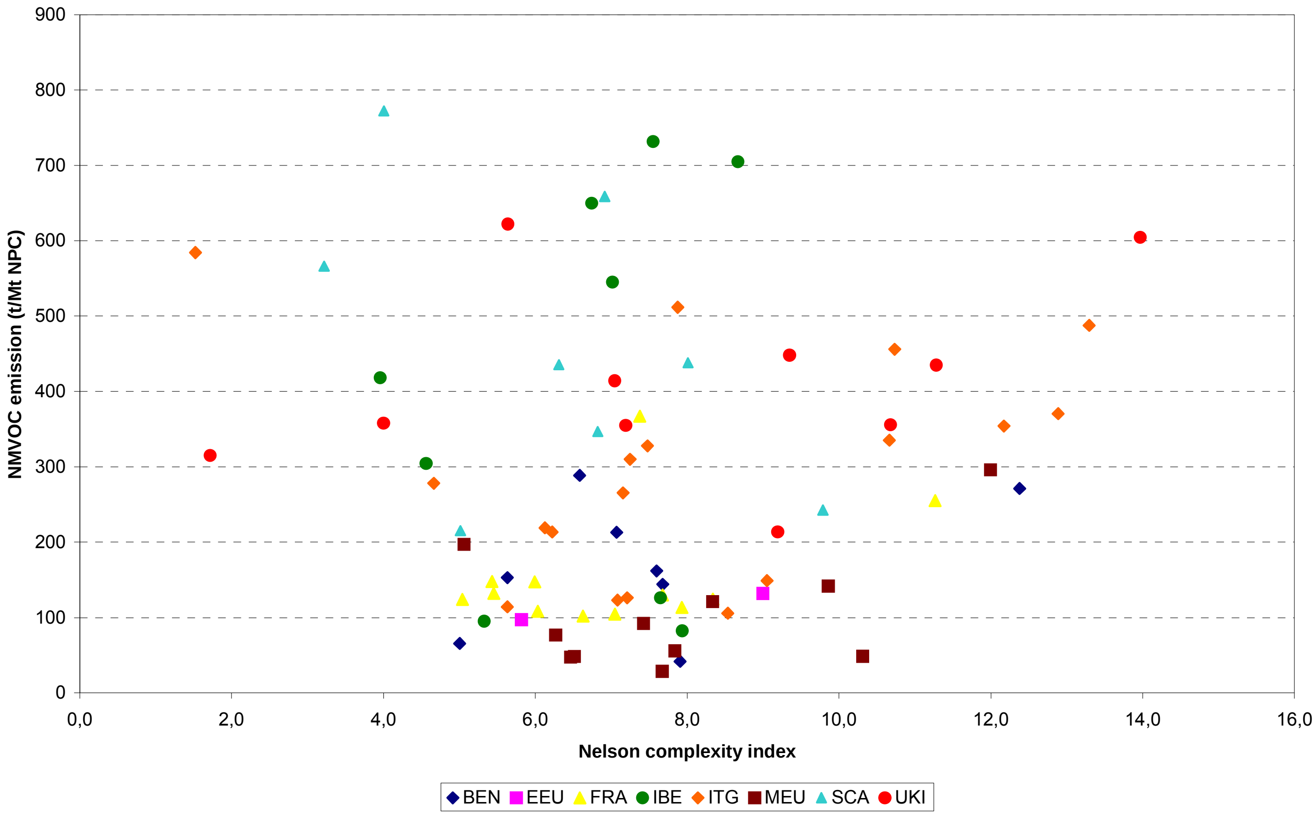
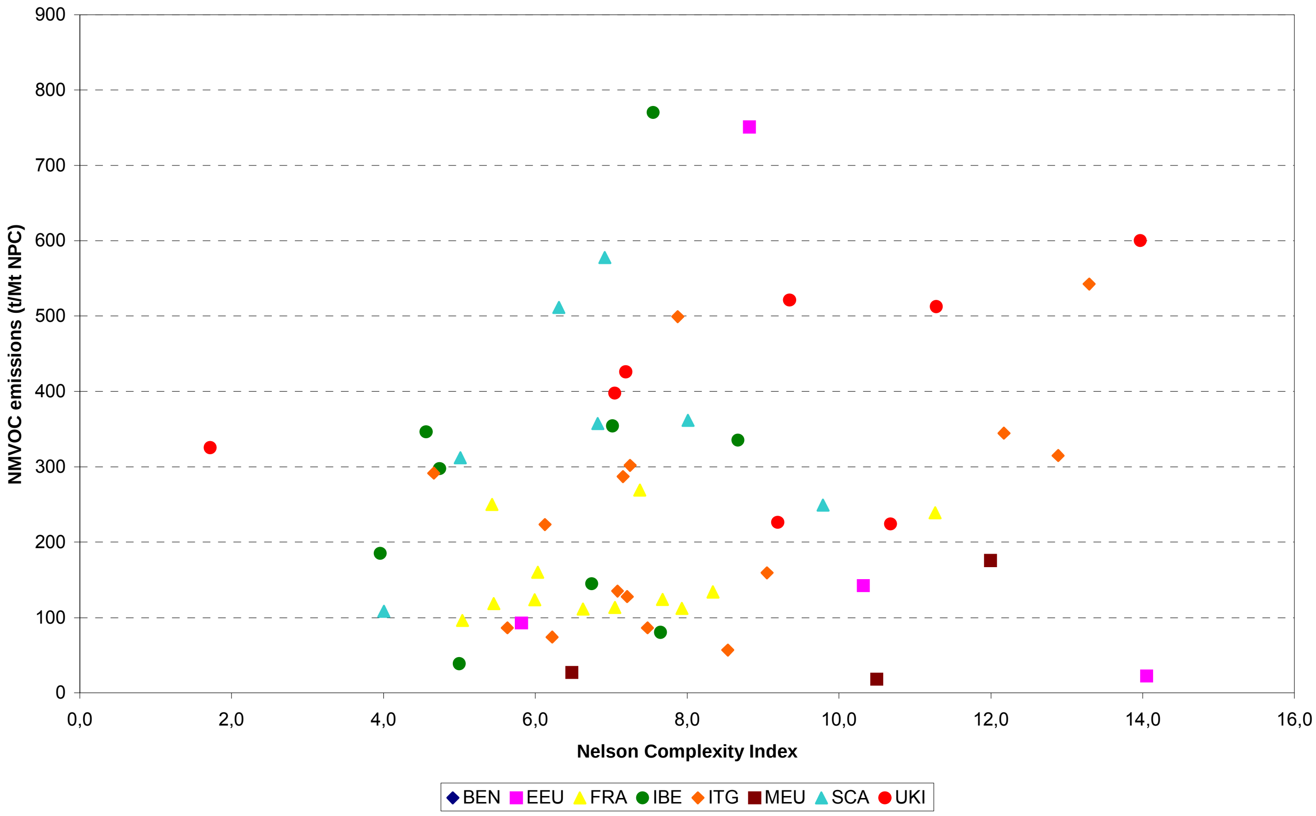


Table 4.14 Evolution of the region average NMVOC load bubble over the period 2001-2004

Region	Region average PM load bubble (tonne/$Mtonne_{NPC}$) 2001	2004
BEN	166.9	167.5
EEU	No data	97.3
FRA	171.8	154.8
IBE	465.2	406.5
ITG	253.8	296.3
MEU	116.6	104.8
SCA	485.1	459.5
UKI	415.1	412.2

Regions are as described in Section 4.3.2 of this report.

Figure 4.11 NMVOC load bubble (based on NPC) as a function of Nelson complexity index in 2006



Evolution of country-wide load bubbles for NMVOC

The combination of the country wide NMVOC emission data from refineries as officially reported within the framework of the Convention on Long Range Transboundary Air Pollution (CEIP emission database) and the country-wide refinery crude oil throughput as officially reported to Eurostat allows for the calculation of country-wide load bubbles. These have been calculated for the period 1996 (year of adoption of the IPPC Directive) until 2006 (the most recent year for which data are available). This evolution is shown in Appendix G for the different countries. For some Member States, the CEIP emission database does not contain data for all years, explaining the gaps that might appear in some of the figures.

The country-wide load bubble for NMVOC shows relatively little variation over the period 1996-2006 for most Member States except Spain, Poland, Bulgaria and the Czech Republic which show a decrease; this may be the result of NMVOC emissions being calculated by means of correlations that are mainly based on throughput. A wide variation in country-wide NMVOC load bubbles for the most recent year (2006) is obvious from the data presented in Table 4.15.

Table 4.15 Evolution of the country-wide NMVOC load bubbles (t/Mt$_{throughput}$) for the individual Member States over the period 2001 – 2006

Region	Member State	Country-wide average NMVOC load bubble (tonne/Mtonne$_{throughput}$)		
		2001	2004	2006
BEN	BE	13.8	11.9	12.5
	NL	17.3	22.2	8.4
EEU	CZ	31.9	1.0	2.3
	PL	11.5	10.3	5.5
FRA	FR	6.9	6.6	6.9
IBE	ES	18.9	19.6	15.3
	PT	7.7	8.1	8.0
ITG	CY	631.5	896.1	
	GR		26.3	32.8
	IT	9.8	9.5	9.6
MEU	DE	9.3	8.9	9.2
SCA	DK	0.3	0.2	0.1
	FI	2.1	5.7	4.7
	LT		2.1	4.7
	SE	4.6	4.4	4.3
UKI	IE	1.2	1.3	1.6
	UK	4.4	4.2	4.3
BG	BG		9.8	8.4

Regions are as described in Section 4.3.2 of this report.

4.5.7 Discharges to water – total organic carbon (TOC)

Analysis of the EPER data for TOC

Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

The TOC load to water for most of the refineries in the year 2004 was lower than 30 g/tonne$_{NPC}$. The TOC load is found not to be dependent on the refineries' complexity (Appendix G).

Analysis of recent individual refinery data for TOC

Yearly total TOC emissions from 20 individual refineries for the year 2006 have been collected from publicly available data. Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Appendix G shows the calculated 2006 TOC load bubble to water as a function of the Nelson complexity index for the various regions in Europe.

Data on discharges of TOC to water for both 2004 and 2006 are available for 17 individual refineries. 12 out of these 17 individual refineries had a lower TOC load bubble in 2006 compared to the situation in 2004, while the remaining five refineries had a higher TOC load bubble in 2006. Evolution of the percentage change in TOC load bubble over the period 2004-2006 for the individual refineries is illustrated in Appendix G.

4.5.8 Discharges to water – phenols

Long term evolution for phenols

Concawe undertakes a long term follow-up on EU wide refinery hydrocarbon emissions to water, based on a regular enquiry addressed to their members. Over recent years, some additional pollutants (COD, BOD, NH_4-N, N_{tot} and phenols) have also been included in this survey.

The table below provides an overview of the evolution of the EU-wide refinery emissions of phenols to water for the period 1993 to 2000. The data indicate a gradual decrease of the average load of phenols.

Table 4.16 Evolution of the EU wide average load bubble to water for phenols

	EU wide average load bubble ($g/tonne_{throughput}$)			BAT-based AEL load
	1993	**1997**	**2000**	**$g/tonne_{throughput}$**
Phenols	0.41	0.32	0.16	N/A

Analysis of the EPER data for phenols

Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

The phenols load to water for most of the refineries in the year 2004 was lower than 0.1 g/tonne$_{NPC}$. The phenols load was found not to be dependent on the refineries' complexity (Appendix G).

Analysis of recent individual refinery data for phenols

Yearly total phenols emissions from 30 individual refineries for the year 2006 have been collected from publicly available data. Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Appendix G shows the calculated 2006 phenols load bubble to water as a function of the Nelson complexity index for the various regions in Europe.

Data on discharges of phenols to water for both 2004 and 2006 are available for 25 individual refineries. 12 out of these 25 refineries had a lower phenols load bubble in 2006 compared to the situation in 2004, while the remaining 13 refineries had a higher phenols load bubble in 2006. Evolution of the percentage change in phenols load bubble over the period 2004-2006 for the individual refineries is illustrated in Appendix G.

4.5.9 Discharges to water – Total N

Long term evolution for total N

Based on the Concawe survey referred to above, for total nitrogen, the EU wide refinery emissions in 2000 amounted to 7.4 g/tonne$_{throughput}$, while the BAT-based load bubble range for this pollutant is 0.5-15 g/tonne$_{throughput}$. There are no earlier data available on the EU wide refinery emissions for total nitrogen.

Analysis of the EPER data for total N

Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

20 out of 24 refineries (83%) that reported emissions of N_{tot} in 2004 met the BAT-based load AEL for this compound. As for the other pollutants to water, there is no dependence of the load on the refineries' complexity (Appendix G).

Analysis of recent individual refinery data for total N

Yearly total N emissions from 21 individual refineries for the year 2006 have been collected from publicly available data. Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Appendix G shows the calculated 2006 total N load bubble to water as a function of the Nelson complexity index for the various regions in Europe. 18 out of 21 refineries (86%) that reported emissions of N_{tot} in 2006 met the BAT-based emission load for this compound.

Data on discharges of total N to water for both 2004 and 2006 are available for 10 individual refineries. Six out of these 10 individual refineries had a lower total N load bubble in 2006 compared to the situation in 2004, while the remaining four refineries had a higher total N load bubble in 2006. Evolution of the percentage change in total N load bubble over the period 2004-2006 for the individual refineries is illustrated in Appendix G.

4.5.10 Discharges to water – biological oxygen demand (BOD)

Long term evolution for BOD

Based on the Concawe survey referred to above, for BOD, the EU wide refinery emissions in 2000 amounted to 10.35 $g/tonne_{throughput}$, while the BAT-based load bubble range for this pollutant is 0.5-11 $g/tonne_{throughput}$. The EU-wide average BOD load bubble to water is just within the range of the BAT-based AEL load. There were no earlier data available on the EU wide refinery emissions for BOD.

Analysis of recent individual refinery data for BOD

Yearly BOD emissions from nine individual refineries for the year 2006 have been collected from publicly available data. Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Appendix G shows the calculated 2006 BOD load bubble to water as a function of the Nelson complexity index for the various regions in Europe. Five out of nine refineries (55%) that reported emissions of BOD in 2006 met the BAT-based load AEL for this compound.

4.5.11 Discharges to water – chemical oxygen demand (COD)

Long term evolution for COD

Based on the Concawe survey referred to above, for COD, the EU wide refinery emissions in 2000 amounted to 50.85 $g/tonne_{throughput}$, while the BAT-based load bubble range for this pollutant is 3-70 $g/tonne_{throughput}$. The EU-wide average COD load bubble to water is within the range of the BAT-based load. There are no earlier data available on the EU wide refinery emissions for BOD.

Analysis of recent individual refinery data for COD

Yearly COD emissions from 18 individual refineries for the year 2006 have been collected from publicly available data. Load bubbles have been calculated for the various refineries based on their nameplate capacity, as described earlier in this section.

Appendix G shows the calculated 2006 COD load bubble to water as a function of the Nelson complexity index for the various regions in Europe. 13 out of 18 refineries (72%) that reported emissions of COD in 2006 met the BAT-based load AEL for this compound.

4.5.12 Discharges to water – hydrocarbons and NH_4-N

Long term evolution for hydrocarbons and NH_4-N

Based on the Concawe survey referred to above, provides an overview of the evolution of the EU-wide refinery emissions of hydrocarbons and NH_4-N to water for the period 1993 to 2000. The BAT-based emission loads from the BREF are also shown in this table. For both pollutants, a gradual decrease of the EU-wide average load bubble is apparent. The EU-wide average load bubble for hydrocarbons is still outside the BAT- AEL for this compound, while for NH_4-N the EU-wide average load bubble in 2000 just met the BAT- AEL.

Table 4.17 Evolution of the EU wide average load bubble to water for hydrocarbons and NH4-N

	EU wide average load bubble ($g/tonne_{throughput}$)			BAT-AEL load
	1993	1997	2000	$g/tonne_{throughput}$
Hydrocarbons	3.62	1.86	1.42	0.01 – 0.75
NH_4-N	10.4	8.0	5.7	0.1 - 6

4.5.13 Analysis of emissions to water from Belgian refineries

Vito (2008) has undertaken an in-depth analysis of the emissions of four Belgian refineries to water. All available monitoring data (concentrations in the effluent of the WWTPs) over the period 2003-2006 have been statistically analysed. The results of this analysis are shown in Table 4.18.

Based on these data it is clear that:

- The BAT-AEL for suspended solids is met by the Belgian refineries with the exception of one or more very high values (this could perhaps be due to a first flush effect due to heavy rainfall after a long period of low rainfall);
- More than 10% of the measured values do not meet the concentration-based BAT-AEL for COD, NH_4-N and N_{tot};
- More than 5% of the measured values do not meet the concentration-based BAT-AEL for BOD;
- Data for the individual metals indicate that the concentration-based BAT-AEL for total metals (<100-4,000 µg/l) is most likely to be met.

All refineries had a wastewater treatment system consisting of:

- gravity separation;
- advanced treatment (flocculation and flotation);
- biological treatment.

Table 4.18 Statistical analysis of monitoring data on the wastewater discharge of four Belgian refineries over the period 2003-2006 (Vito, 2008)

Pollutant	Units	Minimum	Median	Average	90th percentile	95th percentile	Maximum	BAT-AEL
Suspended solids	mg/l	2	10	14.8	24	32	595	2 – 50
COD	mg O2/l	10	72.6	79.82	129.5	147.25	1100	30 – 125
BOD	mg O2/l	2	6	9.33	19	29	80	2 - 20
Kjehdahl-N	mg N/l	2	9.9	11.97	25.1	31	47	
NO_2-	mg N/l	0.1	0.14	0.54	1.6	2.03	5.2	
NO_3-	mg N/l	0.5	3.2	7.3	19	22.3	68	
NH_4+	mg N/l	0.1	6.15	8.28	20	25.15	42	0.25 -10
N_{tot}	mg N/l	< ld	14.2	16.87	30.62	35.82	67.4	1.5 - 25
P_{tot}	mg P/l	0.07	0.47	0.76	0.99	1.21	14.84	
As	µg/l	< ld	10	10	10	10	40	
Cd	µg/l	10	20	10	20	20	230	
Cr	µg/l	10	20	10	20	20	50	
Hg	µg/l	0.1	0.8	0.5	1	1	12	
Ni	µg/l	10	20	30	30	30	530	
Pb	µg/l	< ld	20	20	20	20	130	

Pollutant	Units	Minimum	Median	Average	90th percentile	95th percentile	Maximum	BAT-AEL
V	µg/l	< ld	10	10	30	40	80	
Zn	µg/l	20	40	50	70	80	1020	
AOX	mg/l	6	81.5	153.92	230.2	342.5	2000	
BTEX	mg/l	1.8	2.15	4.26	10.8	14.7	30.1	
PAH	ng/l	158.5	227.5	1551.91	1819.8	3185.8	43400	
F-	mg/l	0.13	1.01	1.27	2.06	2.44	11	
B	mg/l	0.07	0.55	1	0.9	1.16	10	

Note: The shaded figures refer to emissions above the BAT-AELs.

Three of the refineries had an additional polishing step consisting mostly of sand filtration but in some cases there was also an additional flotation unit installed. The main difference between the WWTPs was that only one of the refineries had a nitrification step in the biological treatment (but no denitrification), while the three others had neither a nitrification or a denitrification step.

The performance (effluent concentration) of all plants was identical for all pollutants except for the parameters Kjeldahl-N, NH_4-N and NO_3-N where the plant with the nitrification step showed significantly different effluent concentrations (Table 4.19).

Table 4.19 Influence of a nitrification step on the effluent concentration of N-compounds of a refinery (Vito, 2008)

	Refinery			
	1	2	3	4
Nitrification	Partial	Yes	No	No
Denitrification	No	No	No	No
Average concentration (min - max) (mg N/l)				
Kjeldahl-N	8.1 (2.0 - 47.0)	2.4 (2.0 - 5.9)	13.7 (5.2 - 30.0)	20.8 (8.0 - 46.0)
NH_4-N	4.6 (0.1 - 42.0)	0.2 (<ld - 1.7)	9.0 (1.8 - 21.0)	16.9 (4.6 - 39.0)
NO_2-N	0.7 (0.1 - 5.2)	0.1 (0.1 - 2.0)	1.1 (0.1 - 3.6)	0.2 (0.1 - 1.0)
NO_3-N	18.3 (1.4 - 68.0)	7.8 (0.9 - 19.0)	1.7 (0.5 - 7.4)	0.6 (0.5 - 2.0)
N_{tot}	23.1 (6.3 - 67.4)	9.5 (3.8 - 21.1)	14.7 (7.6 - 32.1)	19.8 (< ld - 46.7)

Shaded values = Exceedance of the BAT-based concentration AEL (10 mgN/l for NH_4-N and 25 mg N/l for N_{tot})

4.5.14 Conclusions from the sector wide analysis

Overview

Data on the extent of permitting progress indicate that, for a number of Member States, coming into line with the requirements of the IPPC Directive in terms of issue of the permits for refineries has largely taken place over the last two to three years. This might be partly due to the fact that the BREF document on mineral oil and gas refineries has only been available since 2003. Taking into account the fact that a number of measures can only be implemented during shut down or turn around of individual installations, the effect of IPPC on emissions from refineries might not yet be fully visible in publicly available data. Data for individual pollutants are considered below.

Sulphur dioxide (SO_2) Based on historic data, the EU wide load bubble for SO_2 (emissions per tonne of crude throughput) is found to have decreased. Data from various regions indicate that there is no clear correlation between the crude sulphur content and the SO_2 load bubble. Only a limited number of individual refineries fall within the SO_2 load bubble benchmark mentioned in the BREF (50-210 or 50-230t per Mt throughput on a yearly basis, as shown in Section 4.4). These units are mainly located in the Scandinavian region (DK, FI, SE) and some in DE and the UK. Evaluation of the long term country-wide load bubbles for SO_2 indicates a decrease in FR, ES, PT and BG but also in DK and SE. Large differences exist between the country-wide load bubble benchmarks for SO_2 for various Member States as can be seen from the table and figure below.

Figure 4.12 Country wide average SO_2 load bubble (tonne/$Mtonne_{throughput}$)

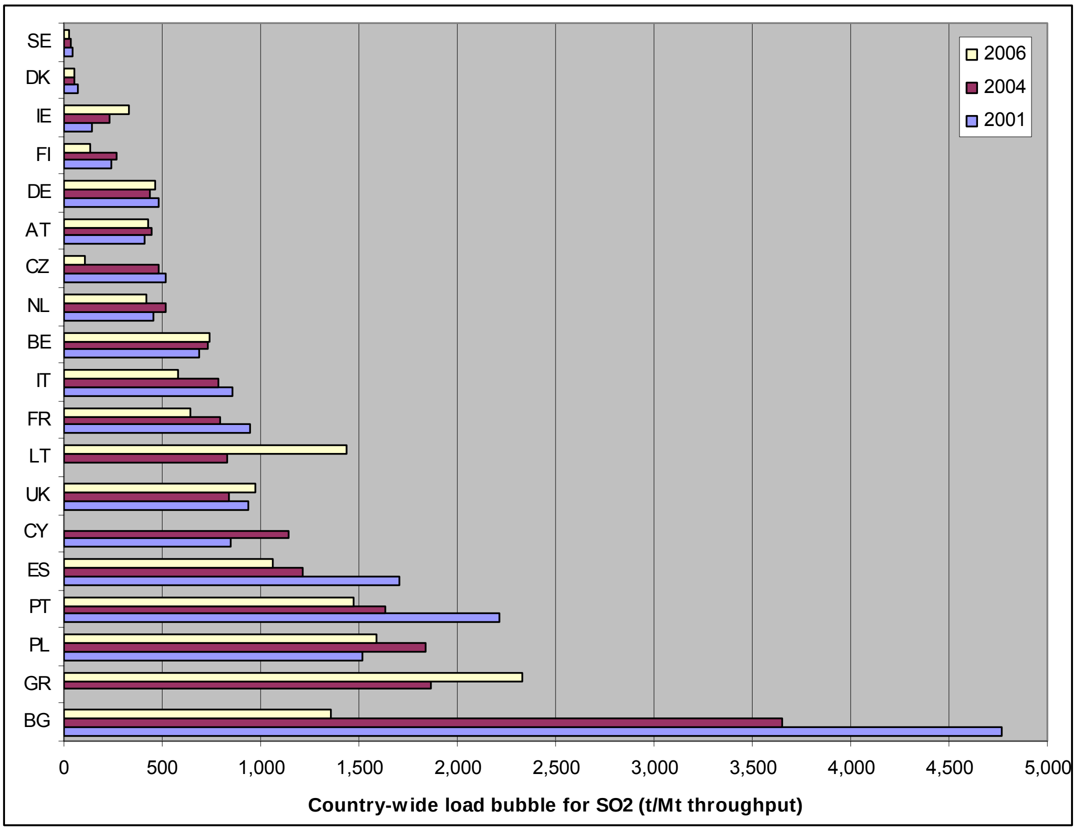


Table 4.20 Country wide average SO_2 load bubble (tonne/$Mtonne_{throughput}$)

Region	Member State	2001	2004	2006
BEN	BE	691	733	745
	NL	452	520	417
EEU	CZ	521	484	***111***
	PL	1,514	1,843	1,593
FRA	FR	950	795	647
IBE	ES	1,701	1,212	1,061
	PT	2,210	1,636	1,477
ITG	CY	848	1,147	
	GR		1,865	2,333
	IT	855	787	582
MEU	AT	409	449	431

Region	Member State	2001	2004	2006
	DE	480	441	467
SCA	DK	***75***	***52***	***51***
	FI	239	267	***133***
	LT		832	1,436
	SE	***42***	***35***	***28***
UKI	IE	***140***	232	330
	UK	934	840	976
BG	BG	4,765	3,653	1,354

Underlined text = Country wide average SO_2 load bubble within range of the BREF load bubble benchmark.
Regions are as described in Section 4.3.2 of this report.

Nitrogen oxides (NO_x)

About a third of the individual refineries fall within the load bubble benchmark from the BREF for NO_x (20-150t per Mt throughput on a yearly basis, as shown in Section 4.4) and some progress is obvious during the period 2004-2006. On a country-wide basis, only NL, SE and CZ fall within the load bubble benchmark for NO_x but a large number of Member States have realised a decrease in the country-wide NO_x load bubble over the period 2001-2006 (NL, DE, ES, IT, DK, LT, FI, BU, CZ, PL, BE). However, large differences still exist between the country-wide load bubble benchmarks for NO_x for various Member States as shown in the table below.

Table 4.21 Country wide average NO_x load bubble (tonne/$Mtonne_{throughput}$)

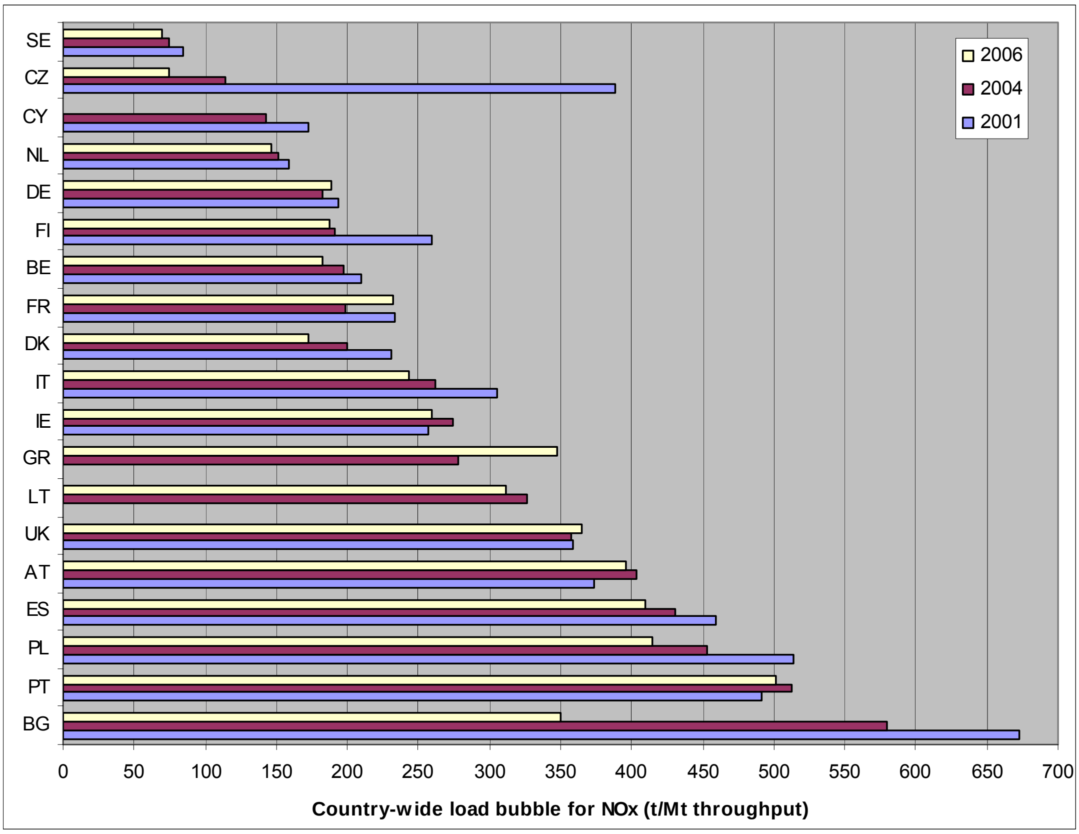
Region	Member State	2001	2004	2006
BEN	BE	210	197	183
	NL	159	151	***146***
EEU	CZ	388	***114***	***74***
	PL	514	453	414
FRA	FR	233	199	232
IBE	ES	459	431	409
	PT	492	513	502
ITG	CY	173	***143***	
	GR		278	348
	IT	305	262	243

Region	Member State	2001	2004	2006
MEU	AT	373	403	396
	DE	193	183	189
SCA	DK	231	200	172
	FI	259	191	188
	LT		326	312
	SE	***85***	***74***	***70***
UKI	IE	257	274	260
	UK	359	357	365
BG	BG	673	580	350

Underlined text = Country wide average NO_x load bubble within range of BREF load bubble benchmark
Regions are as described in Section 4.3.2 of this report.

These data are illustrated graphically in the figure below.

Figure 4.13 Country wide average NO_x load bubble (tonne/$Mtonne_{throughput}$)



Dust

Based on the data from individual refineries, an increase of the dust (PM) load bubble over the period 2004-2006 is the main tendency, which can partly be explained by increased monitoring efforts for this pollutant. The longer-term (since 2001) evolution of the country-wide load bubble benchmark for dust indicates a decrease for the Member States UK, DE, PT, ES, IT, FR, DK, PL and CZ. However, large differences still exist between the country-wide load bubble benchmarks for PM for various Member States, as shown in the table below.

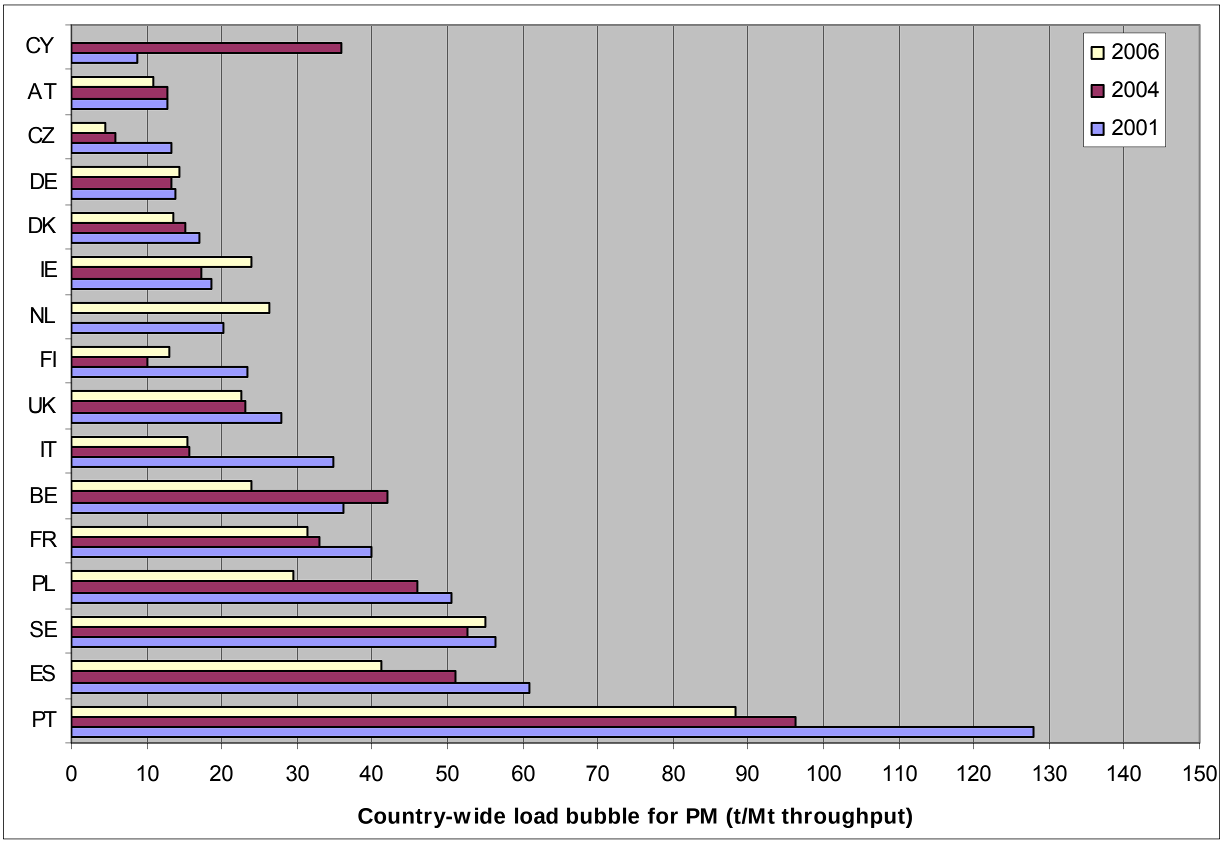
Table 4.22 Country wide average PM_{10} load bubble (tonne/Mtonne$_{throughput}$)

Region	Member State	2001	2004	2006
BEN	BE	36.2	42.1	24.0
	NL	20.2		26.2
EEU	CZ	13.3	5.8	4.4
	PL	50.4	45.9	29.5
FRA	FR	40.0	33.0	31.3
IBE	ES	60.9	51.1	41.1
	PT	127.9	96.3	88.2
ITG	CY	8.7	35.8	
	IT	34.9	15.7	15.4
MEU	AT	12.8	12.7	11.0
	DE	13.8	13.4	14.4
SCA	DK	17.1	15.1	13.5
	FI	23.3	10.1	12.9
	SE	56.3	52.6	55.1
UKI	IE	18.6	17.3	23.9
	UK	28.0	23.1	22.5

Regions are as described in Section 4.3.2 of this report.

These data are illustrated graphically in the figure below.

Figure 4.14 Country wide average PM load bubble (tonne/Mtonne$_{throughput}$)



NMVOC

Based on the data for individual refineries, the majority of installations have achieved a decrease of the NMVOC load bubble over the period 2004-2006. Most country-wide load bubbles for NMVOC show little variation, except for ES, PL, BG and CZ where there is a decrease over the period 2001-2006.

The wide variation observed in the individual refinery load bubbles of pollutant emissions to air according to region and the large differences that exist in country-average load bubbles of pollutant emissions to air, may reflect the different level of implementation of BAT. Based on the sector-wide evaluation and data available for the purposes of this study, it is not possible to say whether the late start of permit review and update in some Member States is an important reason for this, or whether the interpretation and implementation of the IPPC Directive is different from one Member State to another. On the other hand, even in Member States where the permitting or permit review process was already advanced in 2005/2006 (PL, UK, DE, BE), country-average load bubbles were still exceeding the BREF bubble benchmarks in 2006.

Emissions to water – TOC, phenols, N$_{tot}$, BOD and COD

The majority of the individual refineries have achieved a decrease in the TOC load bubble to water over the period 2004-2006. The situation is less clear for the phenols load bubble to water where about half of the individual installations have realised a decrease and the other half an increase of the load bubble to water, although EU-wide long term data indicate a decrease of the EU wide load bubble of phenols to water. More than 80% of the individual refineries have emissions below the BREF load bubble for N_{tot} to water. For BOD and COD, this share reaches 50 and 70% respectively, although this conclusion may be skewed because the data mainly come from a small number of Member States.

4.6 Workshop

4.6.1 Overview

As part of this element of the project, the Commission hosted a workshop event in early July 2008, bringing together experts from industry, authorities and other relevant bodies with practical experience of implementing IPPC in the mineral oil and gas refineries sector. The overall aim of the workshop was to share knowledge, invite discussion and identify further sources of information on issues of implementation of the IPPC Directive in this sector.

The workshop programme was developed around a series of ‘themes’, the aim being to provide a structure within which information from the presentations, comments from delegates and further information could be captured. The themes were:

- Implementation of BAT and use of the BREF document in the permitting process;
- Use of the IPPC Directive’s flexibility in permitting refinery installations;
- Interaction between the ‘bubble’ and ‘BAT-based ELV’ approaches to permitting;
- Exploration of the factors influencing geographical variance in refinery emissions and
- Use and application of cross-sector and other BREF documents.

The workshop was attended by 34 representatives from 12 Member States (BE, DE, ES, FI, FR, HU, IE, IT, NL, PL, SE, UK) with a cross-section from industry, trade bodies and authorities. Representatives from DG Environment and the project team (Arcadis and Entec) were also present.

The workshop structure was split into a morning session comprising introductory presentations from Arcadis and DG Environment together with presentations from:

- Michel Chaugny (JRC, IPPC Bureau) presenting an update on the review of the refineries BREF document;

- Martin Suenson (Europia) presenting an industry body view of the key aspects of the IPPC Directive in the context of the refineries industry;
- Caroline Polders (Vito) presenting the experiences of using General Binding Rules (GBRs) in the process of permitting refineries and
- Kris Devoldere (Arcadis) presenting a review of the refineries BREF with regard to emissions data.

Following the presentations, the group participated in a structured discussion to explore aspects raised within the presentations with particular relevance to the development of the IPPC permit application, determination of the permit conditions and practical use of the BREF documents.

The afternoon session comprised a further series of presentations from:

- Frans Driessen (Netherlands Petroleum Industry Association) presenting practical experiences and challenges of implementing IPPC in the Netherlands;
- Pekka Tuovinen (Neste Oil) presenting a practical case study of IPPC implementation using examples from the Finnish Porvoo Oil refinery;
- Bo Jansson (Swedish EPA) presenting a review of the arrangements in Sweden and a summary of outcomes relating to compliance and monitoring and
- Roy Caughlin (Environment Agency for England and Wales) presenting a summary of the experiences of the regulatory agency in the permitting of UK refineries and a summary of the aspects associated with compliance assessment.

Following the presentations, the group participated in a discussion session focusing on key topics raised within the presentations and a broader discussion on the themes of compliance and reporting, economic implications and escalating operator costs associated with aligning technical reality within the dynamic concept of BAT.

Delegates were informed of the next stages and further questions that would be posed following the workshop. There was recognition from delegates, the consultants and the European Commission that the workshop was a successful forum for discussions relating to aspects of IPPC implementation; consideration would be given to the potential for similar workshop events in the future.

4.6.2 Workshop outcomes

Overview

The workshop outcomes have been presented below as summary points, grouped as far as practicable within one of the five key themes previously highlighted. Within each theme, questions were posed to attendees at the workshop in order to identify further sources of information and views on the various aspects of implementation in this sector.

Implementation of BAT and use of the BREF document in the permitting process

There were some clear differences in use of BAT-AELs from the BREF documents with some Member States reporting direct transposition as ELVs by use of GBRs and others using a more interpretative approach to setting refinery-specific ELVs guided by the BREF document ranges and making use of the flexibility offered by the IPPC Directive.

There was general agreement that both Operators and Competent Authorities should focus on aspects of BAT where the greatest environmental benefits are to be gained. The concept of setting ‘environmental goals’ rather than ‘EU-wide norms’ in order to achieve a high level of protection of the environment as a whole was acknowledged by all participants to be something that stakeholders in IPPC should be working towards.

The Swedish EPA highlighted that their experience showed energy efficiency was one of the best mechanisms for reducing overall emissions from refineries based on the less in, less out principle.

Comments were made that some of the costs within the BREF document were outdated given the rise in market value of certain commodities. The JRC invited comments from delegates regarding updated costs and noted that such information would be included in the on-going review of the BREF.

Although there was not a consensus amongst the workshop group, comments were made by a number of delegates regarding the wide BAT-AEL ranges that made interpretation of BAT more difficult when determining some installation permits. Additional guidance and a tightening of BAT-AELs for key pollutants was proposed by some attendees.

Use of the IPPC Directive’s flexibility in permitting refinery installations

One Member State commented that transposition of the requirements of the IPPC Directive into their national environmental law has resulted in many complexities and challenges for refinery operators. The concept of BoBAT (Best of BAT) was introduced to illustrate the fact that prescriptive legal texts require operators to implement measures that are ‘at least’ BAT. The consensus of the workshop on the day was that this situation, whilst complex, was isolated to a specific Member State’s transposition and interpretation of IPPC.

A number of comments received throughout the workshop were related to the aspect of proportionality in interpretation of BAT when setting ELVs. There was general agreement that the key to such proportionality lay with Competent Authorities maintaining a balance between conditions requiring the Operator to make investments to reach BAT standards and proportionality informed through appropriate assessment of local environmental conditions, geographic location and technical characteristics of the installation (Article 9 (4)). This flexibility within the Directive was highlighted as a very positive aspect that would fit well with the concept of ‘optimisation’ where investment is aligned with environmental goals and targeted at areas where the greatest benefit is to be gained. However, it was also acknowledged that, without adequate justification in the use of such flexibility, the possibility for its misuse exists and that this could cause problems in implementation of the Directive in a consistent manner across the EU.

Interaction between the 'bubble' and 'BAT-based ELV' approaches to permitting

Many delegates reported that the 'bubble' approach had been used in setting permit conditions. In many cases, the bubble is set by the Competent Authority, sometimes through GBRs, and is part of the 'toolkit' for installation regulation. Overall the bubble approach was seen as a positive aspect of IPPC implementation enabling flexibility.

The French Competent Authority illustrated that bubble limits for SO_2 within permits for refineries were set using the sum of all BAT-AELs from individual process units. The same approach has been taken in The Netherlands for all pollutants under pressure of environmental NGOs. Some operators considered that this approach may restrict the flexibility to operators in selecting the most cost efficient reduction measures.

The Swedish EPA noted that they found the bubble concept a very flexible way of determining permit conditions relating to emissions. The bubble limits in permits for Swedish refineries are set as 3 year average values, providing the Operator with a high degree of flexibility to alter or change processes without risk of ELV breaches.

Exploration of the factors influencing geographical variance in refinery emissions

From the data presented at the workshop by a number of speakers, it was clear that there is a significant variance amongst Member States between overall level and concentrations of emissions from refineries of similar complexity and size. Generally, it was concluded that the installations located in the more northern areas of Europe emitted lower levels of pollution. As geographical location may influence the determination of BAT-based permit conditions under Article 9(4) of the Directive, clarification on the reasons for such differences was sought from delegates attending the workshop.

A comment regarding the factors influencing geographic differences in emissions profiles highlighted three issues that may contribute to such differences: increased levels of integration of petrochemical assets; higher levels of historic infrastructure development; and organisational restructuring.

Industry noted that 2007-2011 is a period of active and large infrastructure investment within European refineries to bring installations up to BAT standards. Therefore it may be a few years before normalisation/alignment of emission profiles across different Member States is realised.

A number of refineries have had improvement programmes imposed in their permits, mostly based on technical-economical arguments (with implementation having to be done during scheduled installation shut-down).

Use and application of cross-sector and other BREF documents

Industry has reported rapidly escalating project costs associated with improvements to raise the installation standards in line with BAT. One Competent Authority reported that their national guidance document on BAT has taken into account the Economic Impacts and Cross-Media BREF document. It was envisaged that this information would be useful for Operators undertaking site-specific BAT assessments.

The Swedish Competent Authority reported that a specific cost of 60,000 Kr/tonne (€6,300/tonne) reduction for NO_x had been used as a guidance figure in the economic assessment associated with BAT.

4.7 Installation specific findings

4.7.1 Overview

This section provides details of the assessments undertaken for the selected refineries case study installations. For each installation, a **summary of** the results of the analysis is provided in the following sections. The more detailed assessment templates are included in the appendices to this report. The installations included are set out in the table below.

Table 4.23 Summary of installations included for Task 3

Member State	Installation ref (Note 1)	Notes
Belgium	03/BE/13	
Czech Republic	03/CZ/02	
France	03/FR/12	
Germany	02/DE/16	
Greece	03/GR/14	
Greece	03/GR/17	
Italy	03/IT/15	No assessment undertaken as permit not issued in time for inclusion.
Netherlands	03/NL/07	
Poland	03/PL/08	
Slovakia	03/SK/09	
Spain	03/ES/10	
United Kingdom	03/UK/11	

Notes:

1) Installation reference relates to task number, Member State and installation number for the task concerned. Thus 03/BE/13 is an installation under Task 3 of the study, it is located in Belgium and is the 13th installation selected for Task 3 (the installation number may be more than the 12 included in this task because the total numbers include installations that were initially selected and then found not to be suitable, leading to the selection of reserve installations).

Appendix F to this report provides details of the completed templates for each of the installations. The templates also include references to the relevant documents used in the assessments (permits, applications, decision documents, monitoring data, etc.). It should be noted that the analyses presented in Appendix F also include a comparison of permit ELVs and installation performance against the benchmarks set out in the refineries BREF as well as the BAT-AELs. However, the quantitative conclusions presented in this report only cover a comparison against the BAT-AELs.

4.7.2 Case study 1 – Belgium

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 03/BE/13. The information in this table is based on the detailed assessment for this installation in Appendix F1. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation comprises several production units, like: • Unit for desalting of crude oil • Atmospheric (APS) and vacuum distillation (VPS) • Naphtha hydrofining unit (NFH) • Kero hydrofining unit (KERO) • Heavy and light gasoil hydrofining (HGO and LGO) • Gofining • A catalytic reforming unit (power forming POFO) • A catalytic cracker (FCCU) • Sulphur recovery unit (SRU) • LPG-recovery • Alkylation unit • Solvent and asphalt units • A cogeneration unit (COGEN 2) • A unit for steam production, fed with refinery fuel gas (only as back-up for cogeneration unit) The plant has been in operation since 1953 but has been regularly extended and upgraded. The plant has a net capacity of 13,000,000 tonnes of crude per year and a Nelson complexity index of 6.6. The plant is using a mixture of residual (liquid and gaseous) and commercial fuels (natural gas). The share of gaseous fuels and natural gas has been steadily increasing over the last years.
Type of permit / issue date	The base permit of the company was issued on 26 November 1982. In this assessment, two permits (and related application documents) which involve IPPC-relevant changes are considered: • Permit issued on 30 November 2006 concerning amongst others the expansion with a new cogeneration unit; • Permit issued on 6 September 2007 concerning an expansion of the capacity of the de-aromatisation and the vacuum distillation unit. These permits are to be considered as additions to the base permit and the competent authority has the possibility to overrule the conditions in the base permit by setting new conditions in later permits. A limited BAT assessment, not including ELVs to air and water as these are determined by GBR, has been performed, indicating that all installations were operated according to BAT and a review of the base permit was not necessary. The company is currently preparing a permit application and an EIA for the renewal of its permit (Due September 1, 2011).

Basis of BAT determination	The company performed a BAT assessment in November 2004, using a checklist which is based on the BREF for refineries. The BAT-evaluation report of the Competent Authority (July 2007) did not comprise ELVs for air and water emissions because the general binding rules are currently updated to be in line with the BREF. The result of both BAT assessments was that all installations are operated according to BAT.
Permit application	
Requirements of Article 6	The permit applications for the two extensions were found to be fully in line with the requirements of Article 6.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** Most of the permit conditions are taken up into general binding rules (Vlarem II). A limited number of site-specific conditions are included in the company's permit.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	ELVs for the emissions to air and water and measures for the protection of soil and groundwater are laid down in GBRs.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** The permit sets limits based on refinery bubble values rather than ELVs against process specific BAT-AELs. The bubble values that have been set are in line with BREF bubble benchmarks for all air emissions but not in line with BREF bubble benchmarks for water discharges, the limits typically being set higher than equivalent benchmark values. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** The geographic location and local environmental conditions were considered in the EIA. The impact on local air and water quality were assessed to be acceptable and did not require technologies or the setting of ELVs that were more stringent than BAT. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** No
Use of relevant BREF documents in setting permit conditions?	For the permit of 30/11/2006, the decision document quotes a limited check with the BREF for refineries for the proposed technology and the unit under consideration. The BREF is directly mentioned in the decision document. For the permit issued 06/09/2007, the decision document states that an IPPC evaluation for the whole installation has been performed at the same time, but in a separate report. This IPPC evaluation was part of the permitting procedure. Currently, the operator is doing a BAT assessment as part of the EIA within the framework of the application for permit renewal. Based on the BREF ranges, the operator will propose feasible ELVs. In the setting of permit conditions, the competent authority takes into account GBRs (which are regularly updated to be in line with BAT), the outcome of the BAT assessment and the BREF documents, experience in other refineries and the impact on the local environment (assessed in the EIA).

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Monitoring methodology, frequency and the evaluation process are specified in general binding rules. **Are the monitoring requirements sufficiently detailed?** Yes. Monitoring requirements (methodology, frequency, methodology for assessment of results, etc.) are elaborated in GBRs. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** Yes. GBRs in which the monitoring requirements are set out are regularly updated to be in line with the BREF documents. **Does the permit include information on duration in relation to monitoring requirements?** This is specified in the general binding rules.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Several general conditions in general binding rules describe measures and actions to be taken in case of accidents, in order to prevent nuisance and pollution. There are no particular conditions or measures to be taken in other than normal circumstances in the permit itself.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** The ELVs for emissions to air (refinery bubble, process emissions like catalytic cracking and vapour recovery unit) and to water are governed by GBRs, which are referenced in the permit. A CD with the full text of the GBR is also supplied to the operator and the GBRs are regularly updated. In cases where the EIA assesses a significant negative impact on the environment, more stringent ELVs may be imposed in the permit conditions; however, there has been no need to set more stringent GBRs for this installation.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** There are no EQS that require stricter conditions than BAT.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit is valid for a 20-year period. As a number of ELVs are set in GBR, permitting conditions are regularly updated without having to change the permit. ELVs for emissions to air and water within the GBR have undergone reconsideration at the end of 2008 and have become legally binding since the beginning of 2009.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The application/ decision document and permit are available to the public. **Are monitoring records made available to the public?** Data on the emissions to water are available from the website of the Competent Authority on a discharge point level. Data on the emissions to air are available upon request from the Competent Authority.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	Spot samples are taken from the individual stacks and analysed, according to the GBR. A flow proportionate sample of the water discharge is taken; the frequency of analysis for the various parameters is also governed by GBR. For more details, see table on installation performance below.
Operator's compliance with monitoring conditions	Monitoring is performed as laid down in the GBRs.

Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	Data were not made available for this aspect.
Current emissions of key pollutants	This information is provided within the table below.
Assessment of Installation performance against BAT	Figures provided by the installation are on the basis of bubble values and as such, direct comparison to BREF BAT-AELs is not possible.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	Such measures are included in the GBRs and mainly relate to dismantling of installations in such a way as to not affect the environment; disposal of waste materials according to legal requirements; soil sanitation, etc.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** • Review of emission measurements to water and air • Spot samples (water): 2 x/year • Regular on site inspection **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** There has been no need to take further action than the writing of a formal letter. Competent inspection authorities have the possibility to initiate criminal proceedings and may suspend the permit in cases of serious breach of permitting conditions. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** Abnormal circumstances (e.g. emissions during start-up), planned stops, flaring, etc. are notified and discussed in advance. There is reported to be an open communication from the operator towards the CA. The operator reports that they receive limited response to notifications. **Procedures used or action taken by the operator in the event of non-compliance** The operator provides an answer to the communications with a proposal (timing, actions to be taken, etc.) to limit further non compliance.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The CA performs four to six announced visits each year. This frequency is mainly determined by the classification and the size of the installations under the remit of the CA.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Data on the emissions to water are available from the website of the Competent Authority on a discharge point level. Data on the emissions to air are available upon request from the Competent Authority.

Key observations from this case study assessment

For the refinery sector in the Flemish Region of Belgium, most issues are covered by GBR. The GBR are directly applicable, and are also specifically referred to in the permit conditions. GBR mainly cover emission limit values to air and water for the refinery as a whole as well as for specific installations. The GBR for emissions to water are currently being reconsidered in order to be brought in line with the BAT-AEL and the new ELVs are expected to apply from 2009 – 2010 onward. This is the reason why certain issues (emissions to water and air) have not been assessed yet in a BAT-evaluation. Only a limited BAT assessment - based on the BREF documents - was performed which did not result in permit changes. Although the process of adapting the GBR takes some time, it is a major advantage that permit conditions will be updated for the refinery sector as a whole at the same time, instead of adapting individual permit conditions.

The company has a frequent and extensive dialogue with the CA and their advisors, so the permitting process occurs fluently and the necessary information can be delivered quickly. The permit conditions are mostly determined by GBR, which cover all requirements of Article 3 of the Directive.

The current permit ELVs do not enable a clear comparison to be made with BREF BAT-AELs for emissions to air because limits have been set as whole refinery bubbles, which are only comparable against the BREF bubble benchmarks. Permit ELVs are in line with the benchmark values for the whole refinery bubbles. Permit ELVs for emissions to water are generally higher than the BAT-AELs.

Similarly, performance data for air emissions has been reported at a bubble level therefore restricting the ability to draw any direct comparison to process-specific BAT-AELs. Emissions to water appear to be within the BAT-AEL ranges and within permit conditions.

No information on the new GBR ELVs to be set in the future was available for this study.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL[1] (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Refinery bubble	SO_2	770 mg/Nm³	800 mg/Nm³ (Y)	N/A	Yes	N/A	As prescribed in GBR	Spot sampling - Yearly average	273 K, 101.3 kPa, 3% O_2, dry
	NO_x (as NO_2)	220 mg/Nm³	300 mg/Nm³ (Y)	N/A	Yes	N/A	As prescribed in GBR	Spot sampling - Yearly average	273 K, 101.3 kPa, 3% O_2, dry
	Dust	39 mg/Nm³	50 mg/Nm³ (Y)	N/A	Yes	N/A	As prescribed in GBR	Spot sampling - Yearly average	273 K, 101.3 kPa, 3% O_2, dry
Notes: [1] Limit and reported values for air emissions are expressed as bubble values and therefore not directly comparable with relevant process-specific BAT-AELs. Benchmark values for this installation are included in Appendix F.									
Emissions to water									
	SS	3.85 mg/l	60 mg/l	2-50 mg/l	Yes	Yes	As prescribed in GBR	Average of 6 flow proportionate samples	NA
	BOD	< dl	35 mg/l	2 – 20 mg/l	Yes	Yes	As prescribed in GBR	Average of 2 flow proportionate samples	NA
	COD	33.60 mg/l	250 mg/l	30 – 125 mg/l	Yes	Yes	As prescribed in GBR	Average of 6 flow proportionate samples	NA
	N_{tot}	9.49 mg/l	35 mg/l	1.5 – 25 mg/l	Yes	Yes	As prescribed in GBR	NS	NA

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL[1] (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	Metals	0.53 mg/l	5 mg/l	<0.1 – 4 mg/l	Yes	Yes	As prescribed in GBR	Average of 6 flow proportionate samples	NA
Notes:									
Emissions to land									
Notes:									

4.7.3 Case study 2 – Czech Republic

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/CZ/02. The information in this table is based on the detailed assessment for this installation in Appendix F2. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The activities of the Installation are covered under activity “1.2 Mineral oil and gas refineries” as specified in Annex 1 of Directive 2008/1/EC. The IPPC Directive is implemented into Czech Law under Act 76/2002; the installation is covered under Annex 1, activity 1.2 of the Act. The installation is a crude oil refinery and supplier of refined petroleum products. The installation began operation in 1942 and has been under current ownership since 1995. The FCC unit began operation in 2001, allowing for the production of motor fuels and liquefied hydrocarbon gases. It has a high hydrogenation capacity, operating two oil distillation units and four conversion units, and a number of technological facilities that improve the quality of primary distilling products. The annual production is 5.3 million tonnes of crude oil. The installation produces engine fuels and LPG, petrochemicals, heating oils, asphalts and bitumens, sulphur and oil hydrogenates. Some fuels are transported through a pipeline system to various large scale fuel storage sites all over the Czech Republic. The refinery does not operate power/heating plants and the sources of combustion processes emissions (SO_2 and NO_X) are mainly furnaces of plants where crude and petroleum intermediate products are distilled, furnaces for other refining processes plants (catalytic ones in particular), as well as, to a lesser extent, flare burners (during breakdowns, starting up operations, etc.). The two main furnaces are located in the Compact Block part of the refinery for which the combustion gas point sources are the North Flue Duct and the South Flue Duct. The furnace for the FCC unit is one of the main pollutant sources for combustion gases. The pollution sources of VOCs for which emission limits as well as other conditions of operation are prescribed, are mainly large volume storage tanks for crude and petroleum intermediate product storage, tanks for storage of mogases blending components and blended mogases themselves, rail and road loading stations and, to a lesser extent, small volume tanks for storage of special hydrocarbon based solvents and heavy petroleum products. The actual point sources for the above processes for which emission limits as well as other conditions of operation are prescribed, that are monitored for VOC emissions, are vents of tanks, loading stations, recovery units, etc. Hydrogen sulphide is also monitored, which is a by-product of thermal as well as catalytic processing of crude and petroleum cuts. An incinerator plant is in place downstream of the Sulphur Recovery Unit (Claus) to burn the residual hydrogen sulphide gas. The amount of emissions released to the atmosphere from process furnaces depends mainly on the type of fuel used and on the ratio of liquid and gaseous fuels in systems designed for combustion of two phase fuels. During 1998 the liquid fuel fired furnaces of medium sizes started to burn fuel oil with sulphur content below 1%. The refinery has replaced much of the liquid fuel with natural gas, which is now the main fuel used (the ratio is not known). Further details of the production units are included in Appendix F2.
Type of permit / issue date	This was a new permit for an existing installation. The installation was previously regulated under separate licences. The IPPC permit supersedes previous permits/licences. The IPPC permit covers the whole refinery. The permit was formally signed and issued on 31/03/2003.
Basis of BAT determination	The Competent Authority and the Operator used the BREF document for ‘Mineral Oil and Gas Refineries (Draft), the final BREF was published in 2003. The Czech legislation, Act 76/2002, implements the IPPC Directive and sets out the requirements for the exchange of information on BAT. The Operator is required under Regulation 554/2002 to make an

	assessment of BAT within the application. A BAT assessment was requested by the County Office and was undertaken for the installation by the Agency of Integrated Prevention. The existing processes and abatement techniques were assessed against BAT as provided in the BREF for refineries. The operator's BAT assessment covered each of the main process and activities within the installation including: ▪ Desalting ▪ Mineral oil distillation ▪ Visbreaking ▪ Catalytic reforming ▪ Asphalt oxidation ▪ Vapour separation ▪ Sulphur recovery ▪ Hydrocracking ▪ Control of fugitive emissions of VOCs ▪ Storage and handling of materials ▪ Use of resources and energy ▪ Accident Management ▪ Environmental Management Systems The operator's report concluded that nearly all the processes at the installation met BAT. The report identified that the only area that did not fully meet BAT was the sealing of storage tanks, where double sealing was not applied. Techniques that are applied at the installation that can be considered BAT include: 3 multiple stage Sulphur Recovery Units; Visbreaking Unit with soaker; reuse of wastewaters from atmospheric and vacuum distillation; optimisation of vacuum system; optimisation of heat transfer; mineral oil distillation and vacuum distillation units integrated into same unit, amongst other techniques employed. There was no country specific guidance for the refinery sector at the time of the application. Guidance is available on the Ministry of Environment (MoE) website on what is required in an IPPC application and information on the permitting process. Support was also provided through a number of refinery sector workshops run by refinery industry bodies with input from the Competent Authority, the aim of which was to provide consistency across the sector in the IPPC applications.
Permit application	
Requirements of Article 6	It is understood from discussion with the Competent Authority that all elements of Article 6 were addressed in the application, and no further information was requested from the Operator. Only the contents page of the IPPC application was viewed during the site visit and all the relevant sections had been covered (the full details of this application were not made available). Regulation 554/2002 provides the standard template of areas that the IPPC application must cover, which includes a standard application form developed by the MoE. The Operator took part in workshops for refineries at the beginning stages of their application. The Competent Authority had a number of discussions with the Operator on what was required to complete the application in accordance with the requirements of the 76/2002 Act which implements IPPC into Czech law. The Operator commented that they had insufficient time, 3 months, to prepare the application. The Competent Authority also commented that the time given to assess the application, 4 months, was not sufficient for complex installations such as large scale refineries. The Competent Authority stated that further information was not requested. The Competent Authority commented that the IPPC application was of a good standard.

Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The assessment of this installation has shown that conditions are included within the permit that governs the basic obligations of the Operator according to Article 3. The permit sets out general and technical conditions to which the Operator must adhere in order to ensure that the impact of activities on the environment are minimised as far as practicable. These conditions offer protection to air, water, land and groundwater from the activities of the installation. The permit provides separate sections for the following themes: emissions to air and water, waste management, energy efficiency, accident prevention and monitoring requirements.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** ELVs have been set for all main air pollutants from the installation within Section 1(A-S) of the permit (see the tables below). The permit references the relevant GBRs from which the ELVs have been taken i.e. the Clean Air Act subsequent Regulations, 352/2002 (combustion stationary sources) and 353/2002 (other stationary sources). ELVs have been included under each of the main technologies/units of the installation. The ELVs for certain point sources have been varied since the issue of the permit. Stricter limits than those set out in the national legislation have since been applied to many of the point sources. There were a number of variations to the permit; ELVs were changed under a variation to the permit issued on 26/07/2007. The revised limits have been used within this assessment. ELVs have been included for the Vapour Recovery Unit (VRU) for hydrocarbon releases. Further details of ELVs are provided in Table A1.b. **Water:** ELVs for water emissions have not been included within the permit, as all wastewater is treated by another company within a separately permitted wastewater treatment plant. This company treats the wastewater from a number of installations in the area. The Operator did not provide any further the detail of the wastewater treatment during the site visit. There are no further conditions within the permit relating to water emissions, only a reference to the Water Act 254/2001 which must be complied with. **Noise and Vibration:** No specific ELVs have been set for noise levels. The relevant health protection legislation, 502/2000, has been referenced within the permit which the Operator must comply with. **Land:** There are no ELVs for emissions to land within the permit. **Protection of soil and groundwater** There are no ELVs for emissions to soil or groundwater within the permit. The permits contain a number of conditions for the prevention of pollution and accident prevention relating to requirements to protect groundwater and soil. See Question 2 above. **Waste** Conditions for the management of waste at the installation have been included within Question 2 above. **Transboundary considerations** There is no direct reference in the permit to transboundary impacts from the installation. **Further equivalent technical parameters/measures** have been set for: Conditions have been included within Section 1 (O-Q) for the reduction of emissions from emergency flaring.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** An assessment of the permit shows that whilst some of the limits have been set within the BAT-AEL ranges, many are set above the upper range of the BAT-AELs. The permit references GBR 352/2002 which must also be complied with for emissions to air from the following point sources.

Vacuum and Atmospheric Distillation Units

There are no clear BAT-AELs within the BREF to be able to compare permit ELVs to;

Some techniques applied that can be considered BAT include mineral oil distillation and vacuum distillation units integrated into same unit and reuse of wastewaters from atmospheric and vacuum distillation.

Hydrocracking

The ELVs are set higher than relevant BAT-AELs for fuel oil and gas fuel and are therefore not demonstrably based on BAT. The NO_x limit of 200 mg/m^3 is above the BAT-AEL for an installation using primary and secondary pollution abatement (SCR).

Burners at the hydrocracking chambers 5 & 6 were replaced with low NO_x burners to reduce NO_x emissions and also to increasing energy efficiency of the unit and consequently reducing the CO_2 emissions. The hydrocracking unit has undergone modifications to increase capacity.

Isomerisation

There are no clear BAT-AELs within the BREF to be able to compare permit ELVs to.

Catalytic reforming

There are no clear BAT-AELs within the BREF document to be able to compare permit ELVs to. It has not been possible to identify that conditions set in the permit require the operator to utilise BAT techniques that are commensurate with the specific requirements set out in the BREF document in 5.2.6 on page 405.

Hydrogenation Chambers

There are no clear BAT-AELs within the BREF to be able to compare permit ELVs to.

A new selective hydrogenation unit was installed in 2007 for the selective hydrogenation of naphtha fraction, enabling the company to produce all its fuels with a sulphur content below 10ppm (in line with the Clean Fuels Programme implemented between 2002-2007).Burners were also replaced with low NO_x burners. .

Sulphur Recovery Units

The ELV for NOx emissions is higher than the BAT-AEL. However, the limit for H_2S is below the BAT-AEL range. The permit does not specify recovery efficiency for the SRU, whilst the BREF specifies 99.5-99.9% recovery.

North and South Flue Ducts

The ELVs included for these emissions points are not within BAT-AELs for SO_2, NO_X and particulates emissions. Low NO_x burners are installed on the furnaces of the northern and southern flues.

Flares/Emergency torches

There are no clear BAT-AELs within the BREF to be able to compare permit ELVs to.

In 2007, the Operator initiated a project to reduce flaring of combustion gases through boosting the capacity of both the fat gas purification system and of the recontacting system. It is expected that this will lead to a reduction in the need for flaring of gases.

Vapour Recovery Unit

There are no clear BAT-AELs within the BREF to be able to compare permit ELVs to.

In 2007, the pre-shutdown LDAR programme that is in place was extended to and focused on the 'old' hydrocracking technology, the warehouse of the LPG and the tank farm for petrol, crude oil and petrochemical materials. According to measurements taken in 2007, the Operator reported a decrease in VOC emissions from diffuse sources by 37%.

Conditions have not been included for Bitumen production.

Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?

There are no requirements specified in the permit for the Operator to monitor ambient air quality. However, the permit refers to the GBR 350/2002 which sets out the requirements for the monitoring, assessment and management of ambient air quality, which the Operator must comply with.

The Competent Authority commented that geographic location and local environmental issues were considered when setting permit conditions. All relevant authorities for the different components of the environment (air, water, waste, land use etc.) within the area of the installation were part of the consultation process for the permit.

	The limits set in the permit are transposed from GBRs. It is not clear from the assessment how local environmental and geographic conditions and the specific technical characteristics of the installation are taken into account when setting ELVs within the permit.
	Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)? The Operator was unable to meet the 100 mg/Nm^{3}emission limit for NO_x (as originally proposed by the competent authority) emissions and the Competent Authority agreed to increase the limit to 200mg/Nm^3. This limit is higher than the BAT-AEL range for this pollutant.
Use of relevant BREF documents in setting permit conditions?	There is no direct mention of the BREF document within the permit; the permit states that BAT is being applied based on the independent assessment by the Agency for Integrated Prevention. There was no-country specific guidance available at the time of the application and permit determination process. Where GBRs must be complied with, these are clearly referenced. As indicated above, the draft refineries BREF (2003) was reported to be used in setting permit conditions.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit does not specify monitoring methods, frequency and averaging periods. Instead the permit references the key legislation, Clean Air Act 86/2002 and the subsequent Decree s350/2002, 351/2002 and 352/2002 which specify the methods and frequencies for emissions to air. Averaging periods could not be clearly identified within the relevant GBRs. It is not clear from the permit which point sources have continuous measurement and which have manual measurement. Compliance monitoring is undertaken by an external independent auditing group, made up of environmental experts. This group is certified by the Ministry of Environment (MoE), and the inspections are undertaken once or twice a year, the frequency of the inspections is determined by the auditing group, based on their own internal criteria. . During these inspections, all processes are checked in accordance with the IPPC permit and relevant GBRs. This group also carry the EU ETS inspections at the installation. The permit states that all monitoring must be undertaken by a competent person. Section 12 includes conditions for the reporting of information to the Competent Authority and the relevant GBRs that must be complied with when supplying this information. A report on monitoring data must be sent to the Competent Authority once a year. **Are the monitoring requirements sufficiently detailed?** The Operator stated that they are aware of the monitoring requirements from the referenced GBRs within the permit and it is not necessary to have this detail specified within the permit as well. They are satisfied that the permit provides the information that they require. However, it is considered that the monitoring requirements are not sufficient as there are no details given within the permit of monitoring methods and frequency. Only the relevant GBRs have been referenced which provide this information. The measurement/averaging periods could not be located within the GBRs. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** There are requirements to have in place a LDAR programme for VOC emissions, which meets BAT requirements. Otherwise, it is not clear from the assessment how the BREF has been taken into consideration in setting the requirements for emissions monitoring. **Does the permit include information on duration in relation to monitoring requirements?** No, this information could not be located within the permit.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Section 9 of the permit provides conditions for abnormal operations, such as malfunctions and short term interruptions, which have been based on information provided in the operator's IPPC application. The Operator must comply with the requirements set out in the Clean Air Act 86/2002.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes – GBRs are used to set specific ELVs for emissions to air, as well as indicative monitoring standards and general operational conditions that must be complied with. GBRs are also used to specify the level of controls that should be applied to the management of wastes. . The relevant GBRs that apply to the installation are referenced within the permit.

Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** Discussions with the Competent Authority indicated that ELVs set within the permit are transposed from national legislation, and that these limits within the GBRs were developed taking account of the need to comply with relevant EQSs. In addition, if there were any specific local EQS issues, these would have been assessed and appropriate limits set to meet these requirements. According to the Competent Authority, no ELVs are set at stricter levels than the levels achievable by the use of BAT. There are no requirements specified in the permit for the operator to monitor ambient air quality. However, the permit refers to GBR 350/2002 which sets out the requirements for the monitoring, assessment and management of ambient air quality, which the operator must comply with. It is not known if the operator is currently compliant with the requirements of this GBR.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit is valid for 8 years from the issue date, after which the permit is reviewed. There have been a number of variations to the permit since permit issue, with three substantial variations.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The non-technical summary of the permit and the document stating the decision by the Competent Authority are available to the public. The full permit is not available. **Are monitoring records made available to the public?** Monitoring data is not available on the public register. Annual mass emissions are published in the annual Environmental Report, which can be accessed on the company website.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The permit references the relevant GBRs which set out the monitoring to be conducted by the Operator. Emissions from air pollution sources at the installation are monitored by authorised independent measurements and by the Company's internal continuous measurements. The internal continuous monitoring cover measurements of CO, NO_x, SO_2 and particulates from combustion sources and flares at selected point sources. H_2S gas is monitored from the Sulphur Recovery Unit (Claus). Periodic measurements of emissions are taken from other point sources. Fugitive VOC sources are measured and controlled by the LDAR method, which is based on the principle of detecting and immediately repairing hydrocarbon leakage from production facilities. Emissions of volatile organics are monitored at the material storage tanks, intermediate products and final products, equipment for filling tank cars and tank trucks, and the vapour recovery unit (VRU) for the recuperation of hydrogen gases and vapours. Instruments for measuring the humidity and flow rate of flue gases have been installed at all relevant monitoring points.
Operator's compliance with monitoring conditions	Based on discussions with both the Operator and Competent Authority, the installation presently complies with all elements of the permit.

Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	The permit was issued in March 2003. Data on the level of emissions pre-IPPC has been taken from the publications made by the company on an annual basis (2003 report). There is an evident increase in SO2 emissions over this period. Particulate matter and VOC emissions have decreased; all other emissions are variable with no consistent trend evident. Further details are provided in Appendix F2.
Current emissions of key pollutants	This information is provided within the table below (and in Appendix F2).
Assessment of Installation performance against BAT	Monitoring data was reviewed for the 2007 period (the last full year before the site visit took place) and, following the site visit, for monitoring undertaken during 2008. Reported emissions data for 2008 are provided in the table below with data provided for 2007 presented in Appendix F2. During 2007, the refinery was shut down except for storage tanks; all of the refinery's equipment was stopped during the shutdown. Various upgrades were made during 2007, with noticeable changes in emissions in some cases within the 2008 data (see below). Not all emission data was provided. For those emission points where data has been available, the assessment demonstrates that emissions from the majority of point sources (all point sources for 2008) comply with both the permit ELVs and the BAT-AELs. For the majority of emission points, there are no clear BAT-AELs within the BREF document to be able to compare permit ELVs to. However, there were breaches of ELVs and BAT-AELs identified from the monitoring data in 2007. NO_x emissions from the North Flue duct of the main combustion furnace in the Compact Block exceeded both ELVs and BAT-AELs over the measurement period June – November 2007. The Operator indicated in the monitoring report that both these combustion chambers were being retrofitted with low NO_x burners at the time the measurements were taken. Further measurements taken in 2008 (and reported below) were within the ELVs, but still above the BAT-AEL. NO_x emissions from the Isomerisation unit also exceeded ELVs based on the 2007 monitoring data. This was understood to be as a result of problems with the unit. Further monitoring was undertaken in early 2008 which indicated that emissions were within the ELVs and this data is reported below. Mass concentration of TOC for VOCs and Benzene emissions from the VRU also exceeded permit ELVs during the 2007 monitoring period (15/08/2007) though not during the 2008 period (4/11/2008). Monitoring data for CO and H_2S emissions from the Sulphur Recovery Unit was not provided. However the Operator confirmed that there were a number of breaches of the limits for these pollutants during 2007; the H_2S emissions were double the ELV over 18 half-hourly measurements. The Operator indicated that the causes for this were related to disconnection of the unit from the pipelines, failure of air compressors/pumps and other operational problems/failures in the equipment. The Competent Authority was informed of these incidents and a report provided to them detailing the causes of the incidents. Similarly, while specific data were not provided for 2008, it is understood that the emission limit values for CO and H_2S from the Sulphur Recovery Unit were also exceeded in 2008. The Operator confirmed that there were more cases of flaring incidents than usual during 2007; this is understood to be as a result of refinery shutdown during this period. As a result, the Visbreaker Unit has been upgraded to improve efficiency The average recovery efficiency of the SRU during 2007 was 98.5% and in 2008 was 98.51%. On the basis that BAT for the SRU is >99.5%, the performance of the installation is below BAT. In assessing data published by the company as part of its environmental reports in 2006 and 2007 it is apparent that the company has been working towards implementation of BAT through a number of measures. This includes installation of low-NO_x burners, use of secondary seals on storage tanks and leak detection and repair programmes (LDAR). There have been upgrades of key process units including the Visbreaker and Hydrocracking Units and the Sulphur Recovery Unit and the installation of equipment for continuous monitoring of outlet gases. Other improvement measures include the replacement of liquid fuel with gaseous fuel, replacement of wastewater collection pipes and repair of sewage piping.

Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The permit contains a number of conditions designed to ensure that the operator takes the necessary measures to prevent contamination of the site and returns the site to its original state: ▪ A site closure and decommissioning plan is required to be prepared which must be shown to and approved by the Competent Authority County Office. ▪ All products will be pumped out and sold upon site closure. ▪ Decontamination of the site will be done in accordance with the site closure plan. Any contamination will be put through a treatment plant and there is to be no impact on the groundwater quality. ▪ All waste from the site will be stored in an appropriate landfill. ▪ Plant and equipment will be decommissioned/dismantled as set out in the plan.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The Competent Authority ensures compliance with the permit conditions through annual reviews of monitoring data and other reports produced by the Operator. The Competent Authority must undertake a site visit at least once per year to check on processes and controls in place. Other means of ensuring compliance is via site inspections which are carried out once or twice a year by an external independent group, certified by the MoE. The inspections include checks on all processes to ensure that they are in accordance with the permit and the relevant GBRs as specified within the permit. The results of the inspections are reported to the Competent Authority. The Competent Authority and inspection group have their own internal forms and procedures for inspections. The Operator must provide an annual report on air polluting sources and production to the Competent Authority. They are also required to submit a report on waste production and the methods of managing waste onsite. Energy audit reports are also a condition of the permit. The Authority must be informed of any changes or new technology at the installation. A report is required on the assessment of the impacts of the Visbreaker Unit on the environment. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** The Competent Authority stated that there have been no sanctions applied to the Operator. However, the Operator stated that a fine had been given for breach of NO_x emissions limit from the combustion chambers and isomerisation unit as a result of the upgrade of the burners. The Operator was unable to meet the 100 mg/Nm^3emission limit and the Competent Authority agreed to increase the limit to 200mg/Nm^3. This limit is higher than the BAT-AEL range for this pollutant. Further breaches occurred for emission of CO and H_2S form the Sulphur Recovery Unit during 2007. These were reported to the Competent Authority, but no sanctions were applied in this case. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The Operator indicated that they are currently (at the time of the site visit, 2008) compliant with the permit ELVs and conditions. Based on the performance data submitted by the Operator, the majority of emissions from the installation appear to within the permit ELVs, with the exception of those mentioned previously. The majority of reported values appear to below the more stringent BREF BAT-AELs, as far as information is available. The Operator is required to submit an annual report to the Competent Authority that details compliance with all permit conditions. Continuous monitoring is in place for the majority of the point sources for emissions to air, allowing any breaches or anomalies in performance to be identified quickly. A planned maintenance programme is in place to ensure all plant and equipment are operating correctly and to ensure that any issues associated with performance will be identified. The Operator ensures compliance through following internal operating procedures as part of the Environmental Management System (EMS) to manage the key aspects of the installation. The EMS also requires internal audits to be carried out to ensure compliance as well as continual improvement. The Audit Board, comprising members of the Board of Directors, reviews audit results and ensures that follow-up action is taken where required. **Procedures used or action taken by the operator in the event of non-compliance** In the event of non-compliance, the operator must inform the Competent Authority. A written report must then be submitted following the incident, with details of the incident, its causes and impacts on the environment and the measures that have/will be taken to prevent a reoccurrence.

Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** It was not confirmed how many inspections the Competent Authority have undertaken in the last year. Normally, they would carry 1-2 inspections a year, in addition to those undertaken by the independent authority. The Operator offers support as necessary to the competent authority. Inspections by the Competent Authority are usually announced visits.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Monitoring data is not available on the public register. Annual mass emissions are published in the annual Environmental Report, which can be accessed on the company website.

Key observations from this case study assessment

- The IPPC application was found to cover the requirements of Article 6 (though full details were not made available).
- ELVs have been set for all main pollutants for the key installation processes for air emissions. The ELVs have been set using GBRs. Where GBRs apply, these have been clearly referenced within the permit.
- The Competent Authority commented that geographic location and local environmental issues were considered when setting permit conditions, however the processes for considering these factors is not clear and there is no clear evidence in the permit to support this.
- A number of variations to the permit have been made since permit issue, and ELVs for certain point sources have been revised.
- The ELVs that have been set in the permit are, in some cases, higher than the corresponding BAT-AEL (where these are applicable). For example, the ELVs for NO_X and SO_2 emissions from the North and South Flue Ducts of the main combustion furnaces exceed the BAT-AELs. The SRUs achieve a recovery efficiency of 98.5%, which is below the BAT-AEL of 99.5-99.9%.
- The performance of the installation shows that the majority of emissions are within both the ELVs and BAT-AEL ranges. There have been a number of breaches of the ELVs, particularly for NO_x emissions from the combustion chambers and Isomerisation unit as a result of replacement of burners with low NO_x burners in 2007. Further breaches were identified for CO and H_2S emissions from the SRU. also in 2007. Details of what action was taken by the Competent Authority in response to these breaches was not available for this study. The monitoring data provided for 2008 do not indicate breaches of any of the permit ELVs. However, it is understood from the monitoring report provided that there were also breaches for CO and H_2S emissions from the SRU in 2008 (though the specific data were not made available).
- Where BAT-AELs are available, the performance of the installation based on the 2008 monitoring data indicates that emissions were in within the upper end of the BAT-AEL range for the majority of the emission points. However, NOx emissions from the North and South flue ducts in the compact block were above the upper end of the BAT-AEL range.
- The SRUs achieve a recovery efficiency of 98.5%, which is below the BAT-AEL of 99.5-99.9%.
- The permit does not clearly set out where continuous emissions monitoring is in place.
- The permit does not provide details of monitoring requirements for the installation. The permit references the relevant GBR which sets out monitoring requirements. It was not clear from the GBRs what the relevant measurement/averaging periods are.
- Compliance monitoring is undertaken by an external independent auditing group, made up of environmental experts. This group is certified by the Ministry of Environment (MoE), and the inspections are undertaken once or twice a year including inspections by the Competent Authority.
- A non-technical summary of the permit and the document stating the decision by the Competent Authority are available to the public. The full permit is not available. Monitoring data is available upon formal request.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units) (2007 data)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
North Flue Duct Combustion furnace in the Compact Block (KB NRL sever) (Date of measurement 27/2/2008 and 11/8/2008)	CO	0.0-1.0 mg/Nm^3	100 mg/Nm^3	No BAT-AEL	Yes	N/A	Continuous See Notes	See notes 6 & 7 (applies to all rows)	3% O_2
	NO_x	157-167 mg/Nm^3	200 mg/Nm^3	20-150 mg/Nm^3 (Gas)	Yes	No (See Note 7)	Continuous See Notes		3% O_2
	SO_2	1-19 mg/Nm^3	900 mg/Nm^3	50-850 mg/Nm^3	Yes	Yes	Continuous See Notes		3% O_2
	Particulates	1.3-2.4 mg/Nm^3	50 mg/Nm^3	5-20 mg/Nm^3	Yes	Yes	Continuous See Notes		3% O_2
South Flue Duct Combustion furnace in the Compact Block KB NRL jih (Date of measurement 27/2/2008 and 12/8/2008)	CO	0-5 mg/Nm^3	100 mg/Nm^3	No BAT-AEL	Yes	N/A	Continuous See Notes		3% O_2
	NO_x	163-171 mg/Nm^3	200 mg/Nm^3	20-150 mg/Nm^3 (Gas)	Yes	No (See Note 7)	Continuous See Notes		3% O_2
	SO_2	2-8 mg/Nm^3	900 mg/Nm^3	50-850 mg/Nm^3	Yes	Yes	Continuous See Notes		3% O_2
	Particulates	1.9-5 mg/Nm^3	50 mg/Nm^3	5-20 mg/Nm^3	Yes	Yes	Continuous See Notes		3% O_2
PS 05	CO	0 mg/Nm^3	100 mg/Nm^3	No BAT-AEL	Yes	N/A	See Notes		3% O_2

Emission point reference	Pollutant	Installation performance (inc. units) (2007 data)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Isomerisation (Date of measurement 27/3/2008)	NO_x	184 mg/Nm³	200 mg/Nm³		Yes	N/A	See Notes		3% O_2
VD PSP Vacuum Distillation (Date of measurement 5/6/2008)	CO	6 mg/Nm³	100 mg/Nm³	No BAT-AELs	Yes	N/A	See Notes		3% O_2
	NO_x	172 mg/Nm³	200 mg/Nm³		Yes	N/A	See Notes		3% O_2
	SO_2	278 mg/Nm³	900 mg/Nm³ (Note 8)		Yes	N/A	See Notes		3% O_2
Hydrocracking Unit (SJ PSP - Furnace 1320 B01, 1321 B01/B02) (Date of measurement 7/7/2008)	CO	4.0 mg/Nm³	100 mg/Nm³	50-100 mg/Nm³ [1]	Yes	Yes	See Notes		3% O_2
	NO_x	113 mg/Nm³	200mg/Nm³	40 – 150 mg/Nm³ [2] 100-300 mg/Nm³ [1, 2]	Yes	Yes	See Notes		3% O_2
	SO_2	6.0 mg/Nm³	35 mg/Nm³	10-350 mg/Nm³ [3]	Yes	Yes	See Notes		3% O_2
Hydro cracking Unit (SJ PSP Furnace 1321 BO3) (Date of measurement 8/7/2008)	CO	3 mg/Nm³	100 mg/Nm³	50-100 mg/Nm³ [1]	Yes	Yes	See Notes		3% O_2
	NO_x	93 mg/Nm³	200 mg/Nm³	40 – 150 mg/Nm³ [2] 100-300 mg/Nm³ [1, 2]	Yes	Yes	See Notes		3% O_2
	SO_2	4 mg/Nm³	35 mg/Nm³	10-350 mg/Nm³ [3]	Yes	Yes	See Notes		3% O_2

Emission point reference	Pollutant	Installation performance (inc. units) (2007 data)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Catalytic Reforming B01-04 (Date of measurement 13/8/2008)	CO	4 mg/Nm^3	100 mg/Nm^3	No BAT-AEL	Yes	N/A	See Notes		3% O_2
	NO_2	83 mg/Nm^3	200 mg/Nm^3		Yes		See Notes		3% O_2
Catalytic Reforming B05[6] (Date of measurement 13/8/2008)	CO	2 mg/Nm^3	100 mg/Nm^3	No BAT-AEL	Yes	N/A	See Notes		3% O_2
	NO_x	172 mg/Nm^3	200 mg/Nm^3		Yes	N/A	See Notes		3% O_2
VBU Visbreaking Unit (Date of measurement 11/8/2008)	CO	3.0 mg/Nm^3	100 mg/Nm^3	No BAT-AEL	Yes	N/A	Continuous See Notes		3% O_2
	NO_x	92 mg/Nm^3	200 mg/Nm^3		Yes		Continuous See Notes		3% O_2
Atmospheric and Vacuum Distillation B01 (Date of measurement 12/8/2008)	CO	28 mg/Nm^3	100 mg/Nm^3	No BAT-AEL	Yes	N/A	See Notes		3% O_2
	NO_x	40 mg/Nm^3	200 mg/Nm^3		Yes		See Notes		3% O_2
	SO_2	19 mg/Nm^3	900 mg/Nm^3		Yes		See Notes		3% O_2
	Particulates	3.0 mg/Nm^3	50 mg/Nm^3		Yes		See Notes		3% O_2

Emission point reference	Pollutant	Installation performance (inc. units) (2007 data)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Atmospheric and Vacuum Distillation B02 (Date of measurement 12/8/2008)	CO	4 mg/Nm^3	100 mg/Nm^3	No BAT-AEL	Yes	N/A	See Notes		3% O_2
	NO_x	55 mg/Nm^3	200 mg/Nm^3		Yes		See Notes		3% O_2
	SO_2	6 mg/Nm^3	900 mg/Nm^3		Yes		See Notes		3% O_2
	Particulates	3 mg/Nm^3	50 mg/Nm^3		Yes		See Notes		3% O_2
KO 11 Hydrogenation chamber (Date of measurement 28/3/2008)	CO	11 mg/Nm^3	100 mg/Nm^3	No BAT-AELs	Yes	N/A	See Notes		3% O_2
	NO_x	150 mg/Nm^3	200 mg/Nm^3		Yes		See Notes		3% O_2
KO 12 Hydrogenation chamber (Date of measurement 27/3/2008)	CO	10 mg/Nm^3	100 mg/Nm^3	No BAT-AELs	Yes	N/A	See Notes		3% O_2
	NO_x	160 mg/Nm^3	200 mg/Nm^3		Yes		See Notes		3% O_2
KO 5,6 – B01/B02 Hydrogenation chamber (Date of measurement 12/8/2008)	CO	18 mg/Nm^3	100 mg/Nm^3	No BAT-AELs	Yes	N/A	See Notes		3% O_2
	NO_x	65 mg/Nm^3	100 mg/Nm^3		Yes		See Notes		3% O_2
	SO_2	13 mg/Nm^3	900 mg/Nm^3		Yes		See Notes		3% O_2
	Particulates	2 mg/Nm^3	15 mg/Nm^3		Yes	N/A	See Notes		3% O_2

Emission point reference	Pollutant	Installation performance (inc. units) (2007 data)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
KO 5,6 – Hydrogenation chamber - Reboiler (Date of measurement – No data)	CO	No data	100 mg/Nm^3	No BAT-AELs	No data	N/A	See Notes		3% O_2
	NO_x	No data	200 mg/Nm^3		No data		See Notes		3% O_2
	SO_2	No data	900 mg/Nm^3		No data		See Notes		3% O_2
	Particulates	No data	50 mg/Nm^3		No data		See Notes		3% O_2
OXA Deasphalting unit (Date of measurement 26/3/2008)	CO	10 mg/Nm^3	400 mg/Nm^3	No BAT-AEL	Yes	N/A	See Notes		3% O_2
	SO_2	1,316 mg/Nm^3	2,500 mg/Nm^3		Yes		See Notes		3% O_2
	NO_x	77 mg/Nm^3	400 mg/Nm^3		Yes		See Notes		3% O_2
Benzene Distillation (Date of measurement 9/7/2008)	CO	60 mg/Nm^3	100 mg/Nm^3	No BAT-AELs	Yes	N/A	See Notes		3% O_2
	NO_x	174 mg/Nm^3	200 mg/Nm^3		Yes		See Notes		3% O_2
	SO_2	14 mg/Nm^3	900 mg/Nm^3		Yes		See Notes		3% O_2
	Particulates	6 mg/Nm^3	50 mg/Nm^3		Yes		See Notes		3% O_2
Sulphur Recovery Unit (Date of measurement 20/8/2008)	CO	No data	800 mg/Nm^3	No BAT-AELs	No data	N/A	Continuous See Notes		3% O_2

Emission point reference	Pollutant	Installation performance (inc. units) (2007 data)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	NO_x	131.0 mg/Nm^3	500 mg/Nm^3	40-150 mg/m^3	Yes	Yes	Continuous See Notes		3% O_2
	H_2S	No data	10 mg/Nm^3	20-150 mg/Nm^3	No data	No data	Continuous See Notes		3% O_2
Vapour Recovery Unit (VRU) (Date of measurement – 4/11/2008)	Total VOC	20.4 mg/m^3	150 mg/Nm^3	No BAT-AEL	No	N/A	See Notes		
	VOC mass Flux	24.2 g/hour	>3000g/hour	No BAT-AEL	Yes	N/A	See Notes		
	Benzene	5.00 mg/m^3	5mg/Nm^3	No BAT-AEL	No	N/A	See Notes		
	Benzene mass flux	<0.5 g/hour	>50g/hour	No BAT-AEL	Yes	N/A	See Notes		

Emission point reference	Pollutant	Installation performance (inc. units) (2007 data)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions

Notes:

At the time of setting the permit ELVs, the installation used a significant quantity of fuel oil, therefore limits were included for both fuel oil and gas fuel. Currently, the installation has significantly decreased its fuel oil use (quantity unknown), therefore the Operator applies the limits for gas fuel

GBR 350/2002 sets out the monitoring methods and frequencies and the associated Standards for measurements of CO, NO_x, SO_2 and particulates:

CO - non-dispersive infrared spectrometric methods

NO_x – Method unknown

SO_2 – Standard ISO 6767 Tetrachloromercurate and pararsaniline method. Standard ISO/FDIS 10498 UV fluorescence method.

PM10 – CSN ISO 7708 Gravimetric mass determination. Standard EN 12341 Gravimetric mass determination with collection on a filter.

VOC/Benzene – US EPA TO 14 Determination of Volatile Organic in ambient air using passivated canister sampling and gas chromatography analysis with flame ionisation detector. US EPA TO 17 active sampling onto sorbent tubes

1 CO-furnace/boiler for partial oxidation conditions, without abatement.

2 Lower end only applicable when SCR and low sulphur feedstock are used.

3 Lower end of the range only achievable when both low sulphur feedstock and FGD are used.

4 Upper end of the range applicable to feedstocks with very low sulphur/metal content. The BREF identifies that poor reliability of monitoring system and technical difficulties in upgrading ESPs, the upper range can be difficult to reach. In those cases, a limit of 50 mg/Nm^3 can be applied by a combination of abatement techniques.

5 BAT for Sulphur Reduction Units are 99.5-99.9% efficiency and >96% utilisation.

6 Information on averaging period was not provided within the permit, but separately by the Competent Authority. The averaging periods above are the actual averaging periods applied at the installation. Measurements of CO, NO_x, SO_2, particulates and TOC are performed for 6 hours. After this there is an average calculated for every 30 min so that 12 data points are obtained. The average of these 12 values i.e. the 6 hour average must not exceed the permit ELV and each value separately must not exceed 120% of the permit ELV – which value is provided in the table? The 6h average?. H_2S in Sulphur Recovery Unit is being measured 24h/day.

7 The BREF specifies an averaging period of 24hours (daily) therefore, the measured emissions cannot be directly compared with the BAT-AEL range.

8 Note that the ELV presented for 2007 for the VD PSP was 35 mg/m3 and that presented for 2008 was 900 mg/m3. Emissions in 2008 met the latter ELV but not the former.

Emission point reference	Pollutant	Installation performance (inc. units) (2007 data)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to water									
There are no ELVs for emissions to water within the permit. The wastewater treatment plant that treats the wastewater from the installation is managed by another company and is permitted separately.									

4.7.4 Case study 3 – France

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 03/FR/12. The information in this table is based on the detailed assessment for this installation in Appendix F3. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is specialised in refining of crude oil products (18,000,000 Tonnes/y) and storage of liquid fuels (4,000,000 Tonnes). The site comprises the following units: • Primary distillation: 2 atmospheric and 4 vacuum distillation units ; • A catalytic cracker with 2 polymerisation units for propylene and butylene respectively; • 2 catalytic reforming units; • An isomerisation unit to transform pentane and hexane • An ETBE production unit • Several units for diesel desulphurisation ; 2 Merox units; a unit to produce gasoline with low S-content; • A visbreaking unit; • Base oil production • A cogeneration unit for the production of steam and electricity from natural gas (rated thermal input: 151 MWth); • Storage of LPG and liquid hydrocarbon fuels; • A new hydrocracker associated with a methane steam reforming unit and 2 sulphur recovery units (SRU) has been installed in 2006.
Type of permit / issue date	The company is regulated by a framework permit, issued on 14th June 1999, which is an assembly of all permits issued since 1933. As a result of the BAT assessment performed in the 'bilan de fontionnement 1996-2006', some additional requirements (SO_2 reduction) have recently been added to the permit, while other modifications of existing permit conditions (ELVs for discharges to water, ELV for NOx) are currently still under discussion.
Basis of BAT determination	The basis of the BAT determination is the mineral oil and gas refineries BREF.
Permit application	
Requirements of Article 6	All requirements of Article 6 have been met with the exception of the presentation of a detailed energy and material balance. The application document and the EIA did not contain detailed information on the use of raw and auxiliary materials, other substances and energy on an individual installation level.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** All Article 3 requirements are fulfilled in the permit conditions.

Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	All requirements as set out in Article 9(3) of the Directive are covered in the permit. **Air:** ELVs are set for the whole refinery (bubble) in chapter V.3. Specific ELVs for individual point sources are set in Annex A.6. As a result of the assessment of BAT implementation, the refinery bubble for SO_2 has become more stringent (from August 2008 onward) and the point source specific ELVs for SO_2 have been withdrawn. The new refinery bubble includes all installations but a concentration bubble value has to be recalculated to 3% O_2. Consultation on setting new ELVs for NOx and for discharges to water were ongoing at the time of the site visit and should be finalised by the end of 2008. Although most point sources do not have specific ELVs, from August 2008 onward, reporting of emissions on a point source level is still required and corrective actions may be taken by the competent authorities in case an unacceptable increase of emissions from certain point sources should be observed. ELVs for fugitive VOC emissions are set out in chapter V.5.3 The ELVs are summarised in the table below. **Water:** There are 4 discharge points for waste water from the site. For each point of discharge, ELVs are set in Annex A.5. The ELVs are summarised in the table below. **Land:** The operator is allowed to spread used phosphoric acid catalyst (waste from the polymerisation units C3 and C4) on fields. This was permitted in a separate permit issued on 10/04/2008. The permit defines the area for spreading and enforces concentration limits on chemicals (including P_2O_5) and metals.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** Many of the <u>current</u> permit ELVs for emissions to air are substantially higher than the BREF benchmarks and BAT-AELs. Planned future ELVs, in particular the refinery bubble value for SO_2, are substantially reduced from the current limit. However as a bubble value, direct comparison with the BAT-AELs will still not be possible. All future ELVs will be valid as from the next shut down after 01/01/2009. The company is technically bound by the shut downs to have the opportunity to make changes to installations to improve the environmental performance. At present, the limit value for suspended solids is set within the BAT-AEL range; however all other parameters are set outside the relevant BAT-AEL ranges. According to the Competent Authority, the <u>future</u> ELVs for water will meet the BAT-AELs. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** The local environmental conditions and location are considered in the EIA. When bringing ELVs in line with the BREFs, priority is given to those pollutants that may cause a potential threat to human health or may contribute to an exceedance of the air quality standards in the region. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** A less stringent ELV for maximum daily emissions to air may apply if the operator can demonstrate that the more stringent ELV is not technically or economically feasible.
Use of relevant BREF documents in setting permit conditions?	The BREF documents are directly mentioned in the permit.

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Monitoring methodology and frequency are detailed in the permit. **Are the monitoring requirements sufficiently detailed?** Yes **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** It is unclear whether this is the case given that GBRs apply most of the time to monitoring requirements. **Does the permit include information on duration in relation to monitoring requirements?** Yes
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	ELVs have to be met at all times except during start-up and shutdown (according to GBRs).
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** There are no GBRs implementing the IPPC Directive that govern control of the installation (with the exception of monitoring requirements).
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** There is no evidence that EQSs have required stricter conditions than BAT.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The Competent Authority is obliged to reconsider the permit every 10 years.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The permit applications are available for a 1 month period while the issued permit itself is available on the internet. **Are monitoring records made available to the public?** No information is available on this issue.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	Air emissions: The operator reports monthly on the results of self-monitoring, including: • Monitoring results and calculation of daily load of SO_2 and NOx for point sources • Calculation of the bubble for SO_2 and NOx (cogeneration is included in the bubble, but concentrations are recalculated to 3% O_2) • Monitoring results for the cogeneration unit Water emissions: • BOD and Ntot are measured on a weekly basis, other parameters (COD, hydrocarbons, SS, phenol) on a daily basis
Operator's compliance with monitoring conditions	The emission monitoring is compliant with the permit conditions.

Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	These are provided in the detailed assessment in Appendix F3. Permit revision, based on an assessment of BAT implementation by the operator, is currently ongoing and will lead to more stringent ELVs for discharges of SO_2 and NOx to air and for discharges to water. Current installation performance is representative of the situation before the implementation of the IPPC permit was introduced.
Current emissions of key pollutants	This information is provided within the table below.
Assessment of Installation performance against BAT	The most recent (January 2008) air emission measurements indicate that the installation is operating according to the permit limits for all pollutants with the exception of dust emissions from the catalytic cracking regenerator, which are reported as being over twice the ELV and almost three times the BAT-AEL upper limit of 40mg/m^3. The measurements for SO_2 meet the ELVs set in the permit (except for one emission point), but as these are bubble values, direct comparison with the BAT- AELs is not possible. The yearly average for 2006 exceeds the ELV for SO_2 for several emission points and for dust for one emission point. However, the refinery bubble meets the ELV set in the permit.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The obligation to return the site into a satisfactory state is set out in GBRs.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** • Review of monitoring data • Independent sampling • On-site inspections • Consultation between operator and Competent Authority **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** The competent authorities have used enforcement letters to settle a number of minor non-compliances. In case of major non-compliances or non-response to minor non-compliances reports of offence, sanctions and repeal of the permit are possible measures. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** • Monitoring • Use of a predictive air quality model • Long term commitments on the group level **Procedures used or action taken by the operator in the event of non-compliance** The operator will try to solve the non-compliance as soon as possible. In case the non-compliance is foreseen to last over a longer period of time, a dialogue with the competent authority will be started on the necessary measures. As indicated above, sanctions and repeal of the permit could potentially be used in the event of major non-compliance.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** 37 inspections are reported by the authority from which 12 concerned IPPC-compliance.

Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** No information was available on this issue.
Key observations from this case study assessment	
On the invitation of the Competent Authority, a detailed BAT-evaluation was performed which was based on the BREF documents. In order to guarantee a uniform application and interpretation of the BREFs, there are several discussion groups on different levels in order to come to a uniform and clear translation of the Directive into the permit. This nationwide uniform approach (permit conditions, benchmark etc.) for all refineries is an important driver for the operator to comply with the Directive. The permit conditions cover all requirements of the IPPC Directive. The operator applies BAT, but actual ELVs and the current installation performance do not always reach the BAT-AELs. This is particularly noticed when assessing SO_2 emissions from the SRUs and the catalytic cracking unit. In these cases, the permit limits are set higher than the BAT-AELs and performance is reported as being significantly in above (between 3 and 7 times greater) than the respective upper BAT-AEL values. The installation performance on dust emissions is also significantly higher than the upper BAT-AEL value of 40mg/m^3 and above the permit ELV of 50mg/m^3, itself set above the BAT-AEL upper value. The ELVs for NO_x and SO_2 are set as bubble values and direct comparison with the BREF BAT-AELs has not been possible. Both Competent Authority and operator work together intensively, to produce in an environmentally acceptable but technically-economically justifiable way. Although the IPPC Directive has been implemented in the permit, the operator has obtained some rather long transition periods before the permit ELVs are in line with the BREF ranges.	

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL[1] (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Refinery Bubble	SOx (as SO_2)	837.46 mg/Nm³ (January 2008)	1160 mg/Nm³ (D) 1040 mg/Nm³ (Y) From 1/1/2009: 900 mg/Nm³ (D) 750 mg/Nm³ (Y)	N/A	Yes	N/A	GBR	Daily monitoring, monthly average	273 K, 101.3 kPa, dry gas, 3% O_2
		43.59 tonnes/day	55 tonnes/day	N/A	Yes	N/A			
	NOx (as NO_2)	221.6 mg/Nm³ (January 2008)	390 mg/Nm³ (D) 290 mg/Nm³ (Y)	N/A	Yes	N/A	GBR	Daily monitoring, monthly average	273 K, 101.3 kPa, dry gas, 3% O_2
SRU 2	SOx (as SO_2)	7151.9 mg/Nm³ (January 2008)	14000 mg/Nm³	400-2000 mg/Nm³	Yes	No		Continuous monitoring, monthly average	273 K, 101.3 kPa, dry gas, 3% O_2
SRU 1	SOx (as SO_2)	15,638.6 mg/Nm³ (January 2008)	20000 mg/Nm³	400-2000 mg/Nm³	Yes	No		Continuous monitoring, monthly average	273 K, 101.3 kPa, dry gas, 3% O_2
Catalytic cracking regenerator	SOx	2385 mg/Nm³ (January 2008)	4000 mg/Nm³	10 – 350 mg/Nm³	Yes	No		Continuous monitoring, monthly average	
		5572 kg/day	13200 kg/day	N/A	Yes	N/A			

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL[1] (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	Dust	116.9 mg/Nm³ (January 2008)	50 mg/Nm³	10 – 40 mg/Nm³	No	No			
		329.3 kg/day	180 kg/day	N/A	No	N/A			
Notes: [1] Limit and reported values for air emissions are expressed as bubble values and therefore not directly comparable with relevant process-specific BAT-AELs									
Emissions to water									
Point of discharge n° 5 (process and rain water)	COD	82 – 260 mg/l (January 2008)	150 mg/l	30 – 125 mg/l (monthly average)	No (3 of 31 measurements exceeding the ELV)	Yes (Monthly average = 118)	NFT 90101	Daily	
	BOD_5	17 – 51 mg/l	40 mg/l	2 – 20 mg/l	No (1 of 31 measurement exceeding the ELV)	No (monthly average = 32)	NFT 90103	Weekly	
	Suspended solids	5 – 27 mg/l	30 mg/l	2 – 50 mg/l	Yes	Yes (monthly average = 14)	NF EN 872	Daily	
	N_{tot}	23 mg/l	30 mg/l	1.5 – 25 mg/l	Yes	Yes (monthly average = 23)	NFT 90110 NFT 90013 NFT 90012	Weekly	

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL[1] (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	Hydrocarbons	0.3 – 6 mg/l	10 mg/l	Split view: 0.05 – 1.5 mg/l 0.05 – 3 mg/l 0.05 – 5 mg/l	Yes	Yes (monthly average = 1.7)	NFT 90202	Daily	
Emissions to land									
Not applicable									

4.7.5 Case study 4 – Germany

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 02/DE/16. The information in this table is based on the detailed assessment for this installation in Appendix F4. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The company refines crude oil, using several production units, like: • Atmospheric and vacuum distillation; • Hydrocracking and coking; • Isomerisation and reforming; • Calcination of cokes; • Petrochemical processes: a paraffin hydrogenation unit, unit for production of cyclohexane; • Sulphur recovery units The plant has a capacity of about 4,000,000 tonnes of crude per year and a Nelson Complexity Index of 12.
Type of permit / issue date	The company has a basic permit (22/03/1952), which has been updated and extended several times, e.g. changes, expansion, new legislation which needs to be translated for specific installations. The most recent operating permits, which are made as a result of a planned substantial change, were issued on 18/10/2006 (addition of 2 desulphurisation units) and 25/03/2004 (substitution of a coke oven). A separate permit is required for the discharge of water into surface water. The most recent permit for wastewater discharge dates from 21/11/2007, while the original wastewater discharge permit was issued on 17/4/1970 and was updated on 14/12/1993.
Basis of BAT determination	In Germany, the BREF documents are translated into German statutory ordinances (TAs or Technische Anleitungen), which are translated for individual installations by ordinances written by the local authorities. Each time a new TA appears (the most recent version of the TA for air (TA luft) appeared in 2002) the permit is adapted to new ELVs if necessary and feasible. The ELVs in the TAs are based on the BREF documents, but the techniques are not prescribed. The CA can choose to follow the prescriptions from the TA or to deviate from these with justification e.g. local issues, feasibility, actual emissions, technical limitations, etc.
Permit application	
Requirements of Article 6	Although the main alternatives are not discussed in the application (but more informally during the meeting on the permit application), all other requirements of Article 6 are met.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** All Article 3 requirements are covered either by GBRs (BImSchG) or in permit conditions. These include measures for pollution prevention and to ensure that no significant pollution is caused; waste avoidance, recovery and disposal; energy efficiency; accident prevention; and site closure. Further detail is provided in Appendix F4.

Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	Total yearly emissions (expressed in tonnes/year) have been limited for SO_2 and NO_x. For dust, these emissions are still under discussion. Although maximum concentration limit values have been set for SO_2 and NO_x using 4 bubbles, the ELVs for dust and CO are still set for each source of emission.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** The new GBR for large combustion plants (13 BImSchV) and the imposed ELVs are also based on the LCP Directive. These values are the basis for the ELVs in the permit, and may not necessarily be based on BAT. In practice, the permit conditions can differ from the ELVs in the TA Luft in particular cases where the operator can demonstrate that the values are not achievable. This does not seem to have been the case for this installation. It is not clear whether the ELVs for waste water are based on BAT. Some ELVs are set in the “Abwasserverordnung dd. 17/06/2004”, which was partly meant to translate the EU Directives into German legislation. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** An EIA has not been made yet, but the company reports on ambient air quality in the surrounding area yearly on a voluntary basis. These data are considered during the permitting process. There is no information available on whether these conditions have been taken into account while determining ELVs for waste water. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator’s economic circumstances)?** No
Use of relevant BREF documents in setting permit conditions?	There is no direct mention of the BREF documents, because the CA mostly uses the TAs and GBRs during the setting of permit conditions. The BREF documents are taken into consideration when updating and amending the TAs and GBRs.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Yes. There are GBRs that specify minimum monitoring requirements for emissions to air. In practice, the operator has to propose a monitoring programme, which has to be approved by a certified body. Monitoring requirements for wastewater are specified in GBRs. **Are the monitoring requirements sufficiently detailed?** Yes **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** Yes. GBRs are in line with the BREFs. **Does the permit include information on duration in relation to monitoring requirements?** No, this is specified in GBRs.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Yes, e.g. specific measures are included for start-up of the installation.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes. The 3 laws (Federal Immission Control Act or BIMSchG), the Federal Water Management Act (WHG) and the Federal Waste Water Ordinance (AbwV) were updated by an Article Law in 2001 which constitute the transposition of the Directive into GBR. The BREF documents are translated into German statutory ordinances (TAs) which are translated for individual installations by ordinances written by the local authorities.

Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** There is no evidence that EQS require stricter conditions than achievable by the use of BAT for this installation.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit does not have an expiry date. The CA confirms that the permit is revised and amended, mostly due to changes in the production process or in legislation. Thus far, the permit has been updated some 150 times. The wastewater discharge permit has been updated twice since its issue in 1970, due to changes in GBRs.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes. The application and the permit are available to the public. **Are monitoring records made available to the public?** Yes, monitoring records are available to the public.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	There is continuous monitoring of dust, Hg, total C, CO, NOx, SOx for the cokers, gasturbines, the boiler, the crude oil distillation and vacuum distillation, the reformer 4 hydrocracker, calcination and hydrocarbon recycling. NOx, SOx, CO and dust emissions of other point sources is monitored once a year. The discharged waste water is monitored on a regular basis. Important parameters are controlled daily, others weekly or monthly. The samples that are analysed are 2-hourly mix samples.
Operator's compliance with monitoring conditions	For the sources requiring continuous monitoring, monitoring complies with the permit conditions. Full details of all permits have not been made available so it has not been possible to check whether the monitoring for other sources is in line with permit conditions.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	No information was available on emissions prior to issue of the IPPC permit.
Current emissions of key pollutants	This information is provided within the table below. The majority of the emissions data provided indicate that the permit requirements are being met, with the exception of six limits, as indicated in the table below.
Assessment of Installation performance against BAT	The installations comply with most of the permit ELVs and BAT-AELs, except for: ▪ the total yearly emission of SO2 per Mtonnes throughput exceeded the BREF benchmark range ▪ the NOx emissions of bubbles 3 and 4 exceed the BREF BAT-AELs (but values were not directly comparable as reported measurements were based on yearly average values and the BREF is daily average) ▪ the permit ELV for dust from the vacuum distillation has been exceeded ▪ the permit ELV for CO is exceeded in the calcination unit and the gas turbines.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	There is no evidence of these measures. The company has to perform frequent soil surveys, to follow up the condition of the site. The CA states that measures at cessation of activities are only enforced for installations for waste treatment. In such cases, the company should take out insurance to ensure the site can be returned to a satisfactory state.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** Operating permit related: ▪ Review of monitoring data and reports; ▪ Yearly on-site inspection (permit situation and compliance); ▪ Monthly meeting with operator and discussion of fixed themes such as waste, safety, etc. During these meetings, the inspector makes a tour of the site and interviews employees. ▪ For noise, spot checks are done from time to time. The CA does not possess control equipment for air emissions to do spot checks, but the results of the continuous online measurements are accessible online by the CA. Waste water discharge permit related: ▪ Control of discharged wastewater composition 5 times a year **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** No. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** Unknown (no interview with the operator was undertaken) **Procedures used or action taken by the operator in the event of non-compliance** Unknown (no interview with the operator was undertaken) as far as operation is concerned. In case of problems in the waste water treatment installation, the Competent Authority is informed. The operator diverts the waste water to buffer tanks from where it is fed gradually to the waste water treatment installation after the problems have been solved.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** There is one announced inspection each year, but the inspector makes smaller inspections tours during the monthly meetings. It is not clear how this inspection frequency has been determined. Independent monitoring of wastewater composition is carried out 5 times a year.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** The monitoring results to air are available to the public. Detailed information on wastewater composition is not publicly available. Yearly load of specific pollutants is publicly available due to other legal obligations (e.g. EPER).

Key observations from this case study assessment

The permits for the installation include conditions such as emission limit values in line with the requirements of the IPPC Directive. BREF BAT-AELs have been incorporated into General binding rules and into Technical Instructions (TAs, e.g. TA Luft). BREF documents are not used as such, but are translated into TAs and GBRs. The TAs are not binding for the operator, but have to be translated into ordinances on an installation level. The CA can grant exceptions for the company, but these must be justified.

There are two CAs which have to work together for the permitting process (a large number of permits and variations have been issued), they act as each others advisors. This may make an integrated approach to environmental issues for the installation more difficult.

According to the CA, there is a good contact, a frequent dialogue and an open area for discussion with the company. In cases where there is discussion regarding permit conditions, the CA asks for a proposal and justification from the operator. This proposal is most likely to be followed by the CA (according to the CA).

The current emission monitoring complies with the permit conditions (according to the CA). Due to the fact that several of the permit limit values are based on the bubble approach, it has not been possible in all cases to make a direct comparison of performance to the BAT-AELs. Where it has been possible to compare performance against BAT-AELs, the submitted data (based on yearly average) indicates the installation does not achieve the BAT-AEL in all cases. Notably, emissions of SO_2 from boliers 8 and 10 are above the BAT-AEL for gaseous fuels but within the range for liquid fuels; emissions of NOx from boilers 8 and 10 and the two gas turbines are above the BAT-AELs for both liquid and gaseous fuels. Permit ELVs for dust (vacuum distillation) and CO (several sources) were reported as being exceeded.

The CAs of the different Länder communicate with each other on an ‘Arbeitskreis’. These meetings are used to discuss issues about permitting of companies of the same kind. This way, the permit conditions and interpretations can be harmonised for the different Länder.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) H/2 : half hourly D: Daily M: Monthly Y: Yearly	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Bubble 1[63]	SO_2	483 mg/Nm³ (Y)	480 mg/Nm³ (M) 430 mg/Nm³ (M) - From 01/09/2013 onwards	N/A	No	N/A	Continuous for atmospheric distillation 1, hydrocracker and reformer 4 / once a year for other sources	Year	N/A
Bubble 2[64]	SO_2	414 mg/Nm³ (Y)	480 mg/Nm³ (M) 430 mg/Nm³ (M) - From 01/09/2013 onwards	N/A	Yes	N/A	Continuous for cokers A&B and calcination / once a year for other sources	Year	N/A

63 Medium distillate desulphurisation 2, 3 and 4, Gasoline hydrogenation 2 and 3, Crude oil distillation 1 and 2, Vacuum distillation 1 and 2, Fuel oil system, Hydrocracker, Reformer 4

64 Reformer 1, Hydeal system, n-paraffin system, Coking A and B, Hydrogen production, Thermal oil system , Calcination

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) **H/2 : half hourly D: Daily M: Monthly Y: Yearly**	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Bubble 3[65]	SO_2	125 mg/Nm³ (Y)	480 mg/Nm³ (M) 430 mg/Nm³ (M) - From 01/09/2013 onwards	N/A	Yes	N/A Meets benchmarks if liquid fuel	Continuous for boiler 8 / once a year for boiler 10	Year	N/A
Bubble 4[66]	SO_2	2 mg/Nm³	480 mg/Nm³ (M) 430 mg/Nm³ (M) - From 01/09/2013 onwards	N/A	Yes	N/A Meets benchmarks	Continuous	Year	N/A
Total yearly emission	SO_2	1855 tonnes/year	1916 tonnes/year 1716 tonnes/year - From 01/09/2013 onwards	N/A	Yes	N/A	N/A	N/A	N/A
Claus (desulphurisati on)	SO_2	NA	Efficiency 99.8%	Efficiency 99.5 – 99.9%	N/A	N/A	N/A	N/A	N/A

65 Boiler 8 and 10, spare boilers

66 Gas turbine 1 and 2

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) H/2 : half hourly D: Daily M: Monthly Y: Yearly	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Bubble 1	NOx	248 mg/Nm³ (Y)	270 mg/Nm³ (M)	N/A	Yes	-	Continuous for atmospheric distillation 1, hydrocracker and reformer 4 / once a year for other sources	Yearly	N/A
Bubble 2	NOx	229 mg/Nm³ (Y)	290 mg/Nm³ (M)	N/A	Yes	-	Continuous for cokers A&B and calcination / once a year for other sources	Year	N/A
Bubble 3	NOx	302 mg/Nm³ (Y)	600 mg/Nm³ (M)	N/A	Yes	N/A	Continuous for boiler 8 / once a year for boiler 10	Year	N/A
Bubble 4	NOx	151 mg/Nm³ (Y)	125 mg/Nm³ (M)	N/A	No	N/A	Continuous	Year	N/A
Total yearly emission	NOx	1416 tonnes/year	1553 tonnes/year 1400 tonnes/year - From 01/09/2013 onwards	N/A	Yes	N/A	N/A	N/A	N/A
Claus 2 & 3	NOx	12.9 mg/Nm³ (Claus 2) 3.1 mg/Nm³ (Claus 3)	350 mg/Nm³	N/A	Yes	N/A	N/A	N/A	N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) H/2 : half hourly D: Daily M: Monthly Y: Yearly	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Middle distillate desulphurisation 2	Dust	2 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	No data	N/A
Middle distillate desulphurisation 3	Dust	1.9 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	No data	N/A
Middle distillate desulphurisation 4	Dust	1.2 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	No data	N/A
Gasoline hydrogenation 2	Dust	2 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	No data	N/A
Gasoline hydrogenation 3	Dust	2 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	No data	N/A
Crude oil distillation 1	Dust	10.3 mg/Nm³	20 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	Continuous	N/A
Crude oil distillation 2	Dust	2 mg/Nm³	20 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	Year	N/A
Vacuum distillation 1	Dust	17.6 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	No	Yes	N/A	Continuous	N/A
Vacuum distillation 2	Dust	2.6 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	No data	N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) H/2 : half hourly D: Daily M: Monthly Y: Yearly	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Fuel oil system	Dust	2.3 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	No data	N/A
Hydrocracker	Dust	2 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	Continuous	N/A
Reformer 4	Dust	2.3 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	Continuous	N/A
Reformer 1	Dust	2 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	No data	N/A
Hydeal system	Dust	2.1 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	No data	N/A
n-paraffin system	Dust	1.8 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	NA	N/A
Coking A	Dust	2.1 mg/Nm³	5 mg/Nm³	10 – 50 mg/Nm³ (liquid)	Yes	Yes	N/A	Continuous	N/A
Coking B	Dust	2.3 mg/Nm³	5 mg/Nm³	10 – 50 mg/Nm³ (liquid)	Yes	Yes	N/A	Continuous	N/A
Hydrogen production	Dust	2.1 mg/Nm³	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	Yes	Yes	N/A	Year	N/A
Thermal oil system	Dust	NA	5 mg/Nm³	5 – 20 mg/Nm³ (liquid)	N/A	Yes	N/A	No data	N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) H/2 : half hourly D: Daily M: Monthly Y: Yearly	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Calcination	Dust	28.2 mg/Nm^3	50 mg/Nm^3	5 – 20 mg/Nm^3 (liquid)	N/A	Yes	N/A	Continuous	N/A
Boiler 8	Dust	12.1 mg/Nm^3	20 mg/Nm^3	5 – 20 mg/Nm^3 (liquid)	Yes	Yes	N/A	Continuous	N/A
Boiler 10	Dust	2.2 mg/Nm^3	5 mg/Nm^3	5 – 20 mg/Nm^3 (liquid)	Yes	Yes	N/A	Continuous	N/A
Gasturbine 1	Dust	2.1 mg/Nm^3	5 mg/Nm^3	5 – 20 mg/Nm^3 (liquid)	Yes	Yes	N/A	Continuous	N/A
Gasturbine 2	Dust	2.2 mg/Nm^3	5 mg/Nm^3	5 – 20 mg/Nm^3 (liquid)	Yes	Yes	N/A	Continuous	N/A
Middle distillate desulphurisatio n 2	CO	5 mg/Nm^3	80 mg/Nm^3	N/A	Yes	N/A	N/A	No data	N/A
Middle distillate desulphurisatio n 3	CO	4.6 mg/Nm^3	80 mg/Nm^3	N/A	Yes	N/A	N/A	No data	N/A
Middle distillate desulphurisatio n 4	CO	3.1 mg/Nm^3	80 mg/Nm^3	N/A	Yes	N/A	N/A	No data	N/A
Gasoline hydrogenation 2	CO	2.1 mg/Nm^3	80 mg/Nm^3	N/A	Yes	N/A	N/A	Year	N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) H/2 : half hourly D: Daily M: Monthly Y: Yearly	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Gasoline hydrogenation 3	CO	5.2 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	No data	N/A
Crude oil distillation 1	CO	2.5 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Continuous	N/A
Crude oil distillation 2	CO	0.25 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Year	N/A
Vacuum distillation 1	CO	1.9 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Continuous	N/A
Vacuum distillation 2	CO	6.5 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	No data	N/A
Fuel oil system	CO	5.8 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Year	N/A
Hydrocracker	CO	5.0 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Continuous	N/A
Reformer 4	CO	5.8 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Continuous	N/A
Reformer 1	CO	5 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Year	N/A
Hydeal system	CO	5.3 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	No data	N/A
n-paraffin system	CO	4.6 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	No data	N/A
Coking A	CO	5.3 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Continuous	N/A
Coking B	CO	5.6 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Continuous	N/A

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units) H/2 : half hourly D: Daily M: Monthly Y: Yearly	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Hydrogen production	CO	5.2 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Year	N/A
Thermal oil system	CO	N/A	N/A	N/A	N/A	N/A	N/A	No data	N/A
Calcination	CO	147.6 mg/Nm³	80 mg/Nm³	N/A	No	N/A	N/A	Continuous	N/A
Boiler 8	CO	3.7 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	Continuous	N/A
Boiler 10	CO	5.6 mg/Nm³	80 mg/Nm³	N/A	Yes	N/A	N/A	No data	N/A
Gasturbine 1	CO	98.5 mg/Nm³	80 mg/Nm³	N/A	No	N/A	N/A	Continuous	N/A
Gasturbine 2	CO	121.5 mg/Nm³	80 mg/Nm³	N/A	No	N/A	N/A	Continuous	N/A
Claus 1	CO	2.9 mg/Nm³	100 mg/Nm³	N/A	Yes	N/A	N/A	NA	N/A
Claus 2	CO	2.8 mg/Nm³	100 mg/Nm³	N/A	Yes	N/A	N/A	NA	N/A
Emissions to water									
Notes: No information on emissions to water was available for this assessment.									

4.7.6 Case study 5 – Greece (1 of 2)

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 03/EL/14. The information in this table is based on the detailed assessment for this installation in Appendix F5. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The primary activity of the installation is “crude oil refinery” and is covered activity “1.2 Mineral oil and gas refineries” as specified in Annex 1 of Directive 2008/1/EC. The refinery comprises the following core process areas as described within section A1 of the IPPC permit: 1) Refinery unit producing a range of fuels, which includes, amongst others, the following process plants: • Units of atmospheric distillation • Unit of thermic pyrolysis • Units of vacuum distillation • Extraction unit of mineral oils • Hydration unit of primary lubricants • Hydrogen production units • Mixing and packaging units of lubricants • Gas separation unit • Unit for desulphurisation of heavy hydrocarbons • Naphtha Hydrotreater unit • Catalytic Reformer unit • Isopentane separation unit • Naphtha isomerisation unit • MTBE production unit • Benzene hydrogenation unit (BENFREE) • Fluid Catalytic Cracker (FCC) Unit • LPG treatment unit • Petrol treatment unit from FCC • Petrol Hydrodesulfurization Unit from FCC • Alkylation unit • LPG treatment units with DEA and MDEA • Propylene dimerisation unit • Sulphur production units / Claus • Tail gas treatment units (from Claus) • Large Combustion Plant, comprising a number of furnaces (most existing, some at construction/commissioning phase), the detail of which is presented in the table at the end of this section 2) Supplementary units / processes such as desalination of sea water units, biological treatment of wastewater, sour water stripping units, vapour recovery units, flaring, loading stations etc.

	3) Storage tanks 4) Port installations and pipelines connecting the refinery with an installation marketing petroleum products
Type of permit / issue date	The permit was issued under transitional arrangements into IPPC from a previous regulatory regime. The permit had not been formally signed / issued, and at the time of the site visit (Oct 2008), an unsigned draft was used for the purpose of this assessment.
Basis of BAT determination	The competent authority has determined BAT through a combination of assessment of the operator's submission of BAT (made as part of the technical reports that are required for the IPPC application) and cross-reference to BREF documents, primarily those on Refineries and Large Combustion Plants. For the determination of emission limit values for point source emissions from combustion plant with a rated thermal input equal or greater to 50 MW, the competent authority has used Directive 2001/80/EC on large combustion plants in order to set limits. For other point source emissions (non-LCP), the competent authority has set emission limits having regard to the BREF on refineries but taking into account the technical characteristics (e.g. higher limit value for particulates due to technical limitations of existing units), geographical location and the local environmental conditions (e.g. stricter noise limits). There is use of existing ministerial laws and decisions when determining other permit conditions. The basis for determination of BAT for water discharges has been made on the national water quality standards and the references contained within the BREF document.
Permit application	
Requirements of Article 6	According to the competent authority, the application contained all the key elements required by Article 6 (no information on alternatives was available). The operator also produced a technical report that considered BAT on existing processes and equipment referencing the relevant chapters within the BREF on mineral oil and gas refineries. Further information is required to be supplied by the operator to the competent authority (in the form of technical reports) as part of the improvement conditions The competent authority indicated that the application was generally of a high standard. A brief assessment of the application showed it to be a comprehensive document; however further requests for technical information were made during the determination period.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit as assessed is a comprehensive document containing a mixture of general and specific conditions in order to ensure that installations are operated in a manner commensurate with the requirements of Article 3 (a)-(f) of the Directive.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** Point source ELVs have been set in the permit (Section B1) for all emission points falling within the scope of the Directive on large combustion plants. ELVs have been transposed directly from Directive 2001/80/EC. These values have been transposed into national legislation through Ministerial Decision KYA 29457/1511/05. For all other units, the competent authority has set limits having regard to the BREF on refineries and discussions with operators. The site has a bubble point ELV for maximum discharge limit of sulphur compounds - 660 kg/h (mean value per year). Central heating boilers less than 50MW need to comply with limits set in the Ministerial Decision KYA 10315/93. **Water:** ELVs have been set in the permit for all discharges made to water based on a prefectoral decisions for the Saronic Gulf. **Land:** No ELVs have been set.

	Protection of soil and groundwater: No ELVs have been set. The permits contain a number of conditions (including pollution prevention / control measures and improvement conditions) relating to requirements to protect groundwater and soil. **Waste** The permit contains a number of conditions relating to waste recovery and management but no specified ELVs. **Transboundary considerations** The competent authorities indicated that conditions are not required in order to control transboundary pollution as the impacts are not likely to adversely affect the environment and air quality of neighbouring Member States. **Further equivalent technical parameters/measures** The permit contains the following equivalent technical measures: • Claus units to be operational ≥96% of the time, including scheduled interruptions for maintenance. • The operational removal efficiency of the sulphur recovery units to be ≥99% for two of the units and ≥99.5% for the other two units. • The operational efficiency of the strip water system for the removal of H_2S and NH_3 to be ≥99.9% and ≥99% respectively. • Maximum permitted concentration of H_2S in the fuel gas used on site - 150 mg/m^3 (BAT-AEL 20-150 mg/m^3). • All refinery boilers to be fitted with low-NO_x burners. Progressive replacement of existing boilers at furnaces for low-NO_x burners.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** The competent authority is required as an absolute minimum to set permit conditions and ELVs in accordance with the relevant Ministerial Decisions and national laws. This is intended to ensure that all European Directive requirements are effectively transposed into installation-level control measures. The priority is those Directives where emission limits are presented (e.g. LCPD). The permit ELVs are therefore are not based on BAT. ELVs for the Existing LCP for emissions of SO_2, NO_x and particulates all exceed BAT-AELs. ELVs for NO_X from the New LCP (gas), particulate matter from the FCC Unit and HF from the alkylation unit are all above the BAT-AELs ranges. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** In accordance with regional and district authorities, the competent authority reviews the use of these ELVs having regard to any particular local factors, including the geographic location, ambient air and water qualities and public sensitivities. There is a local Air Quality Monitoring Network. Dispersion modelling and assessment of pollutant loads on the local surrounding environment is required. In the case of this installation, the competent authority has identified that ELVs set for wastewater releases to the sea are based on a prefectoral decision that is considered stricter than that prescribed in national laws. With regards to noise and vibration the competent authority indicated that residential / holiday houses around the site resulted in a stricter limit being imposed on the south boundaries of the site (55dbA). **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** No specific evidence of this has been identified during the assessment.
Use of relevant BREF documents in setting permit conditions?	The operator made a BAT assessment of actual operations referencing the BREF document on Mineral Oil and Gas Refineries. The competent authority has taken into account the BREFs and relevant Directives (such as the large combustion plant directive) in setting permit conditions, though permit conditions have tended to be set based on the latter rather than the former. There is evidence within the permit that a large number of general and operational conditions have been set in accordance with the requirements given in the BREF.

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains a wide range of conditions relating to the requirement for the operator to monitor emissions. The measurement method, frequency and evaluation process are specified or references made to the relevant national laws. The permit includes a condition that obliges the operator to produce and submit reports on defined frequencies (monthly/annually). **Are the monitoring requirements sufficiently detailed?** The monitoring requirements are very detailed and are considered to be sufficiently detailed by the competent authority (the operator did not provide comment on this aspect). **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** Yes, monitoring requirements are comparable with those specified within the BREF. For measurement of air pollutants, continuous emissions monitoring for SO_2, NO_x, particulate matter and CO is undertaken on the FCC, all LCP units, the SRUs and VOC recovery unit, which is in line with the BREF and LCPD. Periodic monitoring is applied on other air release points. A LDAR programme has been implemented for monitoring of VOC emissions. Requirements for the monitoring of releases to water are also in line with the BREF; the permit enables the operator the flexibility to apply continuous monitoring or 3 spot samples over a 24 hour period. Further details can be found in Appendix F5. **Does the permit include information on duration in relation to monitoring requirements?** The permit includes information on duration in relation to monitoring requirements
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Yes, the permit contains some conditions relating to measures and procedures that must be followed in the event of abnormal operation or fault conditions (e.g. notifying the competent authority for faults of abatement equipment / processes, evidence to justify acid gas not being treated at the Claus unit but sent to flares or combustion sources of units).
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes – GBRs (Ministerial Decisions and national laws) are used to set permit conditions such as monitoring requirements, ELVs and general operational conditions.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The competent authority judges the operator to be applying BAT in most aspects of installation operations. The ELVs as set within the permit have been assessed having regard to local conditions and judged by them to be sufficient to ensure that relevant EQSs are met. Therefore, stricter conditions were not required. Lower noise limits were imposed on the Operator due to the sensitivity of the area.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit is valid for a period of 5 years, after which time, the operator must prepare and submit a new application, provided that, within that period, there are no substantial changes at the installation.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The permit references the ministerial decision (Κ.Υ.Α. Η.Π. 37111/2021/03), that determines how to brief the public and provide for public participation during the environmental permitting process. The application, decision document and permit is thought to be / will be available on a public register. **Are monitoring records made available to the public?** Monitoring records can be made available to the public upon request (they are available to local authorities).

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	Based on a monitoring report submitted by the operators to the competent authorities on 08/05/2008 it has been concluded that current emission monitoring performed by the operator includes; • Monitoring of releases from all stacks of the refinery (periodic); • Continuous CO emission monitoring at the FCC unit • Monitoring of the performance of the Claus unit • Monitoring of sulphur releases • Estimates for other releases based on emission factors • Measurements of subsoil and groundwater pollution (e.g. oil content and hydrocarbons) • Sampling and analysis of seawater to meet Bathing Water Directive limits for marine water quality. • A programme of Leak Detection and Repair is in operation at the site. Note that the monitoring data provided were for 2007. The permit was only issued in 2008 (in draft) and there appear to be some discrepancies between the monitoring requirements set out in the permit and the monitoring undertaken in 2007 (i.e. different references for emission points).
Operator's compliance with monitoring conditions	Based on discussions with both the operator and competent authority, the installation presently complies with all elements of the permit.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	No information has been made available on emissions prior to implementation of the conditions of the permit.
Current emissions of key pollutants	Air emissions monitoring data has been provided within the table below. Water emissions data were not made available for this assessment.
Assessment of Installation performance against BAT	**Current performance:** Air emissions monitoring data for 2007 was reviewed and measurement ranges were used to assess installation performance. It is worth noting that the monitoring report submitted by the operators to the competent authorities presents monitoring data from 2007 whilst the permit provided was (October 2008) at a draft stage, The main conclusions drawn from a comparison of the monitoring report and the ELVs set in the permit are discussed below: ▪ Continuous NO_x and SO_2 monitoring data of FCC units shows that emissions appear to be higher than those set at the permit. ▪ The yearly average on daily basis is 83.3 and 100,7 mg/Nm^3 for NOx and SO_2. High values of 900 mg/Nm^3 relate to 3-4 specific days in 2007. In any case the monitoring data referred to one year before the issue of the permit. ▪ Estimates on monthly average SO_2 and PM concentrations from the new LCP are thought to be higher than those set in the permit, although this may not be true if mixed fuels have been used instead whereas different ELVs apply. The data made available for this study do not specify which fuels have been used. Details on the different ELVs are provided in Appendix F5 and in the notes to the table below. ▪ The limit values in the permit are set when gas is used. The LCPs use mixed fuels so the limits are different and therefore a direct comparison between reported performance and permit ELVs is not possible in some cases. ▪ Where BAT-AELs exist for emission sources, for the existing LCP and Newnew LCP (gas), emissions have exceeded the BAT-AEL ranges. In addition, for the FCC unit, emissions have exceeded BAT-AELs for particulates and SO_2. The operator and Ministry both indicated that performance improvements had been made in recent months and that compliance with the draft permit was being achieved at the time of the site visit (October 2008).

Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The permit requires the full remediation of the area after the permanent cessation of activities. The operator has confirmed that no formal plan has been drafted or submitted to the competent authority for approval as a cessation of activities is not being considered.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The primary measures for checking compliance are performed by the inspection division of the competent authority. The inspectorate undertakes review of submitted monitoring data on a regular basis and supports this with on-site compliance inspections. All results are fed back to the competent authority that reserves the right to conduct on-site inspections if they feel it is necessary or in response to accidents or faults. The local prefecture also retains the right of on-site inspection for wastewater treatment processes/discharges. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** There are a range of measures that can be taken in the event of non-compliance with permit conditions. These include informal and formal communications, enforcement actions (improvements) and suspension/permit revocation. No non-conformances have been noted. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The operator has developed and is implementing a range of integrated management systems such as ISO 14001, EMAS, OHSAS and produces Environmental and social reports. Daily operational checks are undertaken on key elements, including process control, monitoring and compliance with IPPC. Any operational deviation must be communicated back to the environmental team and there are corporate and site-level environmental audits. Results from monitoring are used to establish trends on a daily basis. Monthly management meetings are held where results are reviewed. **Procedures used or action taken by the operator in the event of non-compliance** In the event of non-compliance, necessary actions are identified and taken forward. The competent authority needs to be informed as soon as practicable and corrective actions implemented, which may include emergency response. Action reports, including root-cause analysis are developed and key management roles briefed. Preventative actions and decrease of production capacity will be implemented where necessary. The IPPC permit contains specific procedures and conditions that must be followed in the event of non-compliance.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** There have been no site inspections since the IPPC permit has been drafted. The most recent inspection was in 2006, where a large audit was undertaken. There were no incidents of non-compliance recorded during this audit. The inspectorate department of the competent authority conducts on-site inspections. Typically, the inspectorate undertakes 1 major audit per annum with minor audits where necessary or in response to non-compliance. Both the operator and competent authority highlighted that the operator is required by law to cooperate and provide assistance as may be necessary to the inspectorate.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Monitoring records can be made available to the public upon request (they are available to local authorities).
Key observations from this case study assessment	
The permit is still in a draft stage and the Operator is currently implementing improvement conditions to meet permit requirements. Therefore, the Operator's compliance with permit ELVs could not be fully assessed. • The application contained all the key elements required by Article 6 • The permit had not been formally signed / issued, and at the time of the site visit (Oct 2008), an unsigned draft was used for the purpose	

of this assessment.

- The competent authority has determined BAT through a combination of assessment of the operator's submission of BAT (made as part of the technical reports that are required for the IPPC application) and cross-reference to BREF documents, primarily the reference document on Refineries and Large Combustion Plants.
- ELVs have been set for all main pollutants for the key installation processes for air and water emissions.
- The permit ELVs are based on Ministerial Decisions that transpose directly the key requirements of European Directives and therefore are not based on BAT.
- ELVs for the majority of emissions sources exceed the BAT-AELs (where applicable) and therefore do not meet BAT.
- Since the permit had not (at the time of the site visit) been formally issued, the most recent data (2007) that could be obtained was used to assess installation performance. The performance of the installation shows that certain emissions from the Existing and New LCP and FCC Unit exceeded ELVs and BAT-AEL ranges. Planned improvements such as the replacement of Claus Units and upgrading with low NO_x burners are likely to result in reductions in SO_2 and NO_x emissions from these sources.
- It is considered that the Competent Authority have set ELVs having regard to local factors, including the geographic location, ambient air and water qualities and public sensitivities (in relation to releases to sea and noise).

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (permit/actual)		
							Method / Frequency	Sampling/ measurement time	Reference Conditions
Emissions to air									
Note – the monitoring data submitted for 2007 do not include data for some of the pollutants / units as required in the draft permit, for instance monitoring HF data of tail gas from the alkylation unit or monitoring SO2 and H2S data from the sulphur recovery units. Therefore, installation performance has not been considered for these pollutants / units.									
Permit for all non-LCP existing (currently operational) boilers and furnaces									
All non-LCP (existing units)	Particulates	Unknown (Note 1)	80 mg/m^3	5-20 mg/m^3	Unknown	Unknown	Periodic (min. every three months) or Continuous	Av monthly value (Permit) (BREF is daily average)	(Permit): 101.325kPa O_2 (as measured) 273K (Actual): Not Specified
	SO_2		1700 mg/m^3	5-20 mg/m^3 (clean refinery gas) 50-850 mg/m^3 (liquid fuels)					
	NO_x		450 mg/m^3	20-150 mg/m3 (gas boilers and heaters) 55-300 mg/m^3 (liquid) 20-75 mg/m^3 (gas turbines)					

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (permit/actual) Method / Frequency	Sampling/ measurement time	Reference Conditions
Permit for all non-LCP newly built or commissioned (currently non-operational) boilers and furnaces									
All non-LCP (New units)	Particulates	Unknown (Note 1)	50 mg/m^3	5-20 mg/m^3	Unknown	Unknown	Periodic (min. every three months) or Continuous	Av daily value (Permit) (BREF is daily average) (Note 5)	(Permit): 101.325kPa O_2 (as measured) 273K (Actual): Not Specified
	SO_2		850 mg/m^3	5-20 mg/m^3 (clean refinery gas) 50-850 mg/m^3 (liquid fuels)					
	NO_x		300 mg/m^3	20-150 mg/m3 (gas boilers and heaters) 55-300 mg/m^3 (liquid) 20-75 mg/m^3 (gas turbines)					

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (permit/actual)		
							Method / Frequency	Sampling/ measurement time	Reference Conditions
Currently Operational LCP boilers (falling within National Emissions Ceiling Directive)									
M-1100/1500/ 4700/5700/2100/2200, M-100/200 and boilers A,B,C,D Combined total input of 307MW thermal	Particulates	3 - 84 mg/Nm^3	100 mg/m^3 (Note 2)	5-20 mg/Nm^3	Yes	No	Continuous Emissions Monitoring System	Monthly mean (Permit/Actual) (BREF is daily average) (Note 5)	101.325kPa 0°C 3% O_2
	SO_2	22 – 1594 mg/Nm^3	1700 mg/m^3	50-850 mg/Nm^3	Yes	No			
	NO_x	117 - 306 mg/Nm^3	450 mg/m^3	55-300 mg/Nm^3 (Liquid)	Yes	Yes			
	Particulates	129 t/y (estimate)	301 t/y	No BAT-AELs	Yes	N/A		Annual total (Permit/ Actual)	
	SO_2	2355 t/y (estimate)	5120 t/y		Yes	N/A			
	NO_x	495 t/y (estim)	1355 t/y		Yes	N/A			
New LCP (gas)									
M-7500/M-7600 (Note 3) Combined input	Particulates	30 - 54 mg/Nm^3	5 mg/m^3	5-20 mg/Nm^3	No	No	Continuous Emissions Monitoring System	24 hour average value (Permit/Actual) (BREF is daily	101.325kPa 0°C 3% O_2
	SO_2	807 – 1473 mg/Nm^3	35 mg/m^3	50-850 mg/Nm^3	No	No			

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (permit/actual)		
							Method / Frequency	Sampling/ measurement time	Reference Conditions
of 185MW thermal	NO_x	118 - 197 mg/Nm^3	200 mg/m^3	20-50 mg/Nm^3 (Gas)	Yes	No		average) (Note 5)	
FCC Unit (regeneration of catalyst)									
	Particulates	4.7 - 49.7 mg/Nm^3 (Note 4)	50 mg/m^3	10-40 mg/m^3	Yes	No	Continuous Emissions Monitoring System	24 hour average value (Permit/Actual) (BREF is daily average) (Note 5)	101.325kPa 0°C 3% O_2
	SO_2	8.3 – 900 mg/Nm^3 (Note 4)	200 mg/m^3	10-350 mg/m^3	No	No			
	NO_x	19 – 299 mg/Nm^3 (Note 4)	150 mg/m^3	100-300 mg/m^3	No	Yes			
	CO	0.3 - 35.8 mg/Nm^3 (Note 4)	100 mg/m^3	50 – 100 mg/m^3	Yes	Yes			
Sulphur recovery units									
	H_2S	No data	10mg/m^3	20-150 mg/m^3	Unknown	Unknown	Continuous Emissions Monitoring System	24 hour average value (Permit/Actual) (BREF is daily average) (Note 5)	101.325kPa 0°C 3% O_2
	SO_2	No data	1000 mg/m^3	400 – 2000 mg/m^3	Unknown	Unknown			
Tail gas from the alkylation unit									
	HF	No data	1 mg/m^3	<1 mg/m^3	Unknown	Unknown	Periodic (once per trimester)	Not specified	Not specified

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (permit/actual)		
							Method / Frequency	**Sampling/ measurement time**	**Reference Conditions**
Vapour recovery unit									
	VOC	No data	35 g/m^3	No BAT-AEL	Unknown	Unknown	Continuous Emissions Monitoring System	Average hourly value (Permit)	Not specified
Note 1: For the non LCPs it has not been possible to compare installation performance with permit ELVs because the monitoring data (from prior to permit issue) are provided in a format that does not allow comparison with the draft permit. Note 2: Value of 50 mg/m3 is applicable when liquid fuel has an ash content of <0.06%. Note 3 - If mixed fuel is used (liquid & gas) the limits in Ministerial Decision KYA 29457/1511/05 must be followed. Note 4 – Monitored 0.8-3.8% O2 and 258 - 319°C. Note 5 - Whilst there are some differences in averaging periods between the permit and the BREF, the full data-sets are made available to the Competent Authority during the annual submission of environmental reports.									
Emissions to water									
Notes: No data were made available to enable a comparison between installation performance, permit ELVs and BAT-AELs.									
Emissions to land									
Not applicable.									

4.7.7 Case study 6 – Greece (2 of 2)

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 03/EL/17. The information in this table is based on the detailed assessment for this installation in Appendix F6. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is a hydroskimming refinery operating with an annual processing capacity of 3.4 million tonnes crude oil per annum. The installation operates the following processes under 'Section 1.2 Mineral oil and gas refinery installations' of the IPPC Directive: ▪ Atmospheric distillation (AD) unit; ▪ Vacuum distillation (ADV) unit; ▪ Desulphurisation units (sulphur recovery); ▪ Naptha reforming units; and ▪ Hydro-desulphurisation units. The installation also operates two tanker loading stations, which are located at a separate site. A breakdown of the key emission points, the associated LCP units (including capacities) and ELVs is presented in the table at the end of this case study.
Type of permit / issue date	The permit was issued under transitional arrangements into IPPC from a previous regulatory regime. The permit is dated 13/03/2008 and has therefore been issued after the deadline of 30th October 2007 for Member States to permit their installations according to the IPPC Directive.
Basis of BAT determination	The competent authority has determined BAT through a combination of assessment of the operator's submission of BAT (made as part of the technical reports that are required for the IPPC application) and cross-reference to BREF documents, primarily the reference documents on Refineries and Large Combustion Plants. For the determination of emission limit values for point source emissions from combustion plant with a combined thermal input equal or greater to 50 MW, the competent authority has used Directive 2001/80/EC on large combustion plants in order to set limits. For other point source emissions (non-LCP), the competent authority has set emission limits having regard to the BREF on refineries but taking into account the technical characteristics, geographical location and the local environmental conditions. Existing ministerial laws and decisions have been used when determining other permit conditions.
Permit application	
Requirements of Article 6	The operator made several applications to cover the different installation complexes (refinery and four chemical plants). The application for the refinery was submitted by the operator on 27/07/2007 and approved by the Ministry on 10/08/2007. The permit was issued on 13/03/2008, therefore the determination process took approximately 8 months to complete. The application contained all the key elements required by Article 6. The operator also produced a comprehensive BAT comparison that considered existing processes and equipment in light of other techniques/technologies given within the BREF on mineral oil and gas refineries.

Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit as assessed is a comprehensive document containing a mixture of general and specific conditions that meet the requirements set out in Article 3(a)-(f) of Directive 2008/1/EC. Where the determination process has shown the installation is not currently using BAT, the permit contains specific improvement conditions that require the operator to implement measures based on BAT. The permit sets out timings for implementation of these measures.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	Conditions are placed in the permit that relate to the requirement to comply with the ELVs. These conditions require no unauthorised discharge to any point not specified in the schedule, the limits shall not be exceeded and annual emissions totals shall not exceed the relevant values. **Air:** Point source ELVs have been set in the permit for all emission points falling within the scope of the Directive on large combustion plant. ELVs have been transposed directly from Directive 2001/80/EC. These values have been transposed into national legislation through Ministerial Decision KYA 29457/1511/05. These limits only came into force in January 2008. The competent authority has also used a refinery ‘bubble’, which covers the main pollutant releases (SO_2, NO_x and particulates) that are not already covered by the ELVs set for LCP units. The competent authority’s opinion on setting the ‘bubble-point’ was that in the absence of a clear BAT conclusion on refinery ‘bubble-point’ emission limits, except for SO_2 (according to directive 1999/32/EC, as modified by 2005/33) they utilised the limits given in Directive 2001/80/EC as a guide for setting the ‘bubble-point’ for key pollutants. The bubble point applied to entire site emissions and covered all emission points up to December 2007; however, from January 2008, the LCP units were subject to new ELVs transposed directly from the LCP Directive. Therefore, from January 2008 the bubble point limits only cover non-LCP units. In addition to the above, the permit requires that total emissions of sulphur shall be reduced from 250 kg/hr to 112 kg/hr under the terms of the permit bubble limit. **Water:** ELVs have been set in the permit for all discharges made to water. These are based on national values developed by the Ministry for Water and transposed into national legislation in the form of Ministerial Decisions. **Protection of soil and groundwater:** No ELVs have been set for soil and groundwater as direct discharges are not permitted. **Waste:** The permit contains a number of conditions relating to waste but no specified ELVs. **Transboundary considerations:** It is understood that the procedure for taking into account transboundary pollution was done in accordance with Article 17. The permits indicate that conditions are not required in order to control transboundary pollution as the impacts are not likely to adversely affect the environment and air quality of neighbouring Member States. **Further equivalent technical parameters/measures have been set for:** The permit contains the following equivalent technical parameters/measures: ▪ The operational removal efficiency of the sulphur recovery unit (SRU) and tail gas treatment shall be >99%. ▪ The operational efficiency of the strip water system for the removal of H_2S shall be >99.5%. ▪ The maximum permitted concentration of H_2S in the refinery gas is 200 mg/m^3 (BAT-AEL 20-150 mg/m^3). ▪ Liquid fuels used in the refinery must fully meet the requirements of Directive 2005/33/EC on low sulphur fuels. ▪ All refinery boilers should be fitted with low-NO_x burners where it is technically feasible to do so.

Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** The permit contains a very detailed set of technical and operational conditions (including equivalent parameters and technical measures) that cover all the key elements of BAT as presented within the BREF document on Mineral Oil and Gas Refineries. With the exception of ELVs, the permit conditions do appear to have been based on BAT and cover all elements of Article 3. Examples of this include conditions requiring advanced process control measures, minimum operational availability for key abatement equipment, continuous monitoring, use of refinery fuel gas and oil (with a maximum H_2S value – although these are above BAT) and the development of annual emissions mass balances for those falling under the bubble. In addition to the general BAT requirements, there is also a requirement to conducted leak detection and repair (LDAR) within a defined programme The permit ELVs are based on Ministerial Decisions that transpose directly the key requirements of European Directives and therefore are not based on BAT. For the ELVs to air, these are taken from Directive 2001/80/EC on reduction of emissions of certain pollutants from large combustion plant. Bubble values have been based on those within the LCP Directive, the reason given being the absence of clear guidance (within the BREF for refineries) for setting refinery bubble points. Water ELVs are set according to national standards to ensure protection of marine water quality. These are based on the ecological requirements of the body of water and vary according to the particular water body having regard to its ecological sensitivities. **Sulphur Recovery Unit** The permit specifies a recovery efficiency for sulphur of >99%, which does not go as far as the BREF conclusion on BAT, which specifies 99.5-99.9% recovery. The permit however also contains a concentration based limit of 10mg/m^3, at the incinerator stack.
	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters? In accordance with regional and district authorities, the competent authority reviews the use of ELVs having regard to any particular local factors, including the geographic location, ambient air and water qualities and public sensitivities. In the case of this installation, the operator provided references for a number of technical studies on ambient air quality to demonstrate that the imposition of ELVs as given in the Ministerial Decisions would be sufficient to protect the surrounding environment. These submissions included a pollutant dispersion modelling report, ambient air quality monitoring data and trend analysis and point source emissions from the refinery (for short-term impact assessment). The decision of the competent authority in this instance was that there were no local factors that required the setting of ELVs stricter than within the Ministerial Decisions and that all environmental quality standards and protection of human health could be met with the use of BAT. **Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?** None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** In relation to the more stringent associated emission levels on air emissions presented in the BREF on Mineral Oil and Gas Refining (i.e. PM. SO_2, NO_x), the operator stated that due to its low contribution in air quality terms, stricter emission limits would impose an economic cost to the site that would cause serious viability problems, without any significant environmental improvement.
Use of relevant BREF documents in setting permit conditions?	The operator made a comprehensive assessment of actual operations against BAT as presented in the BREF document on Mineral Oil and Gas Refineries. There is evidence within the permit that a large number of general and operational conditions have been set in accordance with the requirements given in the BREF.

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains a wide range of conditions relating to the requirement for the operator to monitor emissions. The measurement method, frequency and evaluation process are specified or references made to the relevant national laws. The permit includes a condition that obliges the operator to produce and submit reports on defined frequencies (monthly/annually). **Are the monitoring requirements sufficiently detailed?** The monitoring requirements in the permit are very detailed and are judged to be sufficiently detailed. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** Monitoring requirements are based on BAT as presented (interpreted) within the operator's proposals (these were not made available for the purposes of this study). Where it was judged by the competent authority that improvements to bring the measurements in line with BAT were required, these are explicitly listed in the permit improvement programme (e.g. continuous monitoring fitted for pH and dissolved O_2). **Does the permit include information on duration in relation to monitoring requirements?** Yes, duration for each monitoring parameter is included in the permit.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Yes, the permit contains a number of conditions relating to measures and procedures that must be followed in the event of abnormal operation or fault conditions.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** GBRs (Ministerial Decisions and national laws) are used to set permit conditions such as monitoring requirements, ELVs and general operational conditions.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The competent authority judges the operator to be applying BAT in most aspects of installation operations (including the environmentally significant aspect of emissions and discharges). The ELVs as set within the permit have been assessed having regard to local conditions and judged to be sufficient to ensure that relevant EQSs (Community – Air) (National – Water) are met. Both the operator and the competent authority commented during the interview that, prior to determining the permit conditions, substantial local air quality monitoring had been undertaken. On behalf of the operator, this was undertaken by the local University and on behalf of the competent authority, by the regional environmental inspectorate. No details were available at the time of interview; however the results of the monitoring are understood to have been submitted with the technical appendices to the application.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit is valid for a period of 5 years, after which time, the operator must prepare and submit a new application.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes, upon request or available at the competent authority offices. **Are monitoring records made available to the public?** Yes, upon request or available at the competent authority offices.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	**Air emissions** Continuous monitoring of SO_2, NO_x and particulates on all LCP. Periodic monitoring of all remaining point source emissions together with a LDAR programme to minimise fugitive VOC emissions. All emissions monitoring equipment requires independent calibration and testing on an annual basis. All monitoring conducted must comply with the national standards as set out in Greek legislation. **Water emissions** Continuous monitoring of all discharges of BOD, COD, SS, total hydrocarbons, phenol and ammonia,, with additional continuous monitoring currently being installed as per the permit improvement programme. **Other** Mass balances of sulphur, waste monitoring and reporting, energy monitoring and reporting, water minimisation measures and water use figures.
Operator's compliance with monitoring conditions	Yes, based on discussions with both the operator and competent authority, the installation presently complies with all elements of the permit as regards emission monitoring.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	In assessing data published by the company as part of its sustainability and environmental reports in 2006 and 2007 it is apparent that the company has been working towards implementation of BAT through a number of measures prior to issue of the IPPC permit in 2008. This includes maximisation of de-sulphurised refinery fuels in combustion activities, sulphur recovery, low-NO_x burners, use of secondary seals on storage tanks and leak detection and repair programmes (LDAR). The widespread adoption of energy efficiency measures is also noted such as advanced process control, direct downstream product supply heat integration and recovery and additional insulation measures. There is also evidence of BAT measures to reduce wastewaters through re-use and closed-loop cooling circuits, recycling of condensates and application of advanced integrated treatment facilities. Emissions of sulphur dioxide (SO_2) between 2000 and 2006 have remained relatively steady in mass terms within the range 3500-4000 tonnes per annum. Small fluctuations have been noted across the period with a slight drop in total SO_2 emissions from the installation in 2007. Emissions of NO_x have remained relatively steady since 2000 (500 tonnes NO_x) to current levels in 2007 (650 tonnes NO_x). These figures do not take into account of the production increases and therefore an overall drop in *specific* pollutant output terms. Discharges of wastewater were running at approximately 0.3 tonnes per tonne of crude processed (below the CONCAWE benchmark value of 0.55 tonnes). The quality of the effluent (as measured by hydrocarbon index) stood at 1.6 grams per tonne of crude oil processed in 2006, above the CONCAWE benchmark value of 1.45 g/tonne and a notable increase from the 1 g/tonne level reported in 2005. Figures for 2007 show efficiency increases, with discharges of wastewater reported as being 0.26 tonnes/tonne crude processed and a reduction in hydrocarbons to 1.25g/tonnes; below CONCAWE benchmark values and 50% below the regulatory limit.
Current emissions of key pollutants	See the table below.

Assessment of Installation performance against BAT	In the limited number of cases where an assessment has been possible, the installation has demonstrated compliance with the emission limits. An assessment of the installation against BAT has been possible on the basis of the information provided for point source release data – however this is not a complete dataset. Where an assessment of the air emission concentrations was possible, the figures demonstrate that the installation is emitting key air pollutants above BAT-AEL values. The most significant emissions are of SO_2, which are considerably above the upper BAT-AEL value of 850mg/m^3. Emission limit values of 1700mg/m^3 are currently in force and on the basis of discussions with the competent authority and operator, these are presently being met. The refinery bubble concentration limit of 1700mg/m^3 is intended to ensure that where a point-source ELV is not set, the control of emissions is covered. The ELVs set for large combustion plant remain over twice the upper BAT-AEL value as presented in the Mineral Oil and Gas Refining BREF document but are in line with the values as stated within the Large Combustion Plant Directive. Pollutant levels in water discharges are within BAT-AEL ranges with the exception of total hydrocarbons, which at 7.2 mg/l, is above BAT-AEL range of 0.05-1.5 mg/l. It should be noted that the emissions figures supplied relate to 2007 emissions and therefore cover all emissions sources (including LCP units). More recent figures were requested but were not available within the assessment timeframe. The permit indicates that the operator should ensure that the sulphur recovery unit is operating at a level of >99% recovery efficiency and it is clear that in 2007, the operational efficiency was far below this level (96.88%). The conditions of the permit (including the requirement to improve to the performance of the sulphur recovery unit and tail gas treatment to BAT-AEL equivalent standards) came into force after the time period for which current data exists. The operator indicated that there had been recent upgrading of the SRU and tail gas treatment systems (new tail gas clean up unit, installed in January 2008) that would ensure the >99% recovery efficiency would be met. A recent performance test (September 2008) is understood to have verified that the efficiency level is >99% though details of this have not been made available.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The permit requires the development of a site closure plan and the procedures that will form part of this plan have been drafted by the operator although no formal plan has been submitted to the competent authority for approval

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** Checking compliance is the competence of the inspection division (IPPC Inspectorate) of the Ministry of the Environment (competent authority). The Inspectorate is therefore a separate yet related body. The Inspectorate undertakes a review of submitted monitoring data on a regular basis and supports this with on-site compliance inspections. All results are fed back to the competent authority and there remains the ability for the competent authority to conduct on-site inspections if they feel it is necessary or in response to accidents or faults. The local prefecture also retains the right of on-site inspection for wastewater treatment processes/discharges. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** There are a range of measures that can be taken in the event of non-compliance with permit conditions. These include informal and formal communications, enforcement actions (improvements) and suspension/permit revocation. For this installation, it has not been necessary to undertake any enforcement actions since permit issue. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The operator has developed a range of IPPC permit compliance matrices and written the key compliance elements into procedures, which have been briefed to all members of staff in training. Daily operational checks are undertaken on key elements, including process control, monitoring and compliance with IPPC. Any operational deviation must be communicated back to the environmental team and there are corporate and site-level environmental audits. The assessment gathered significant evidence that the operator is using BAT to undertake compliance checks and communicating this right up through the management hierarchy. The key roles for environmental management and those with a responsibility for IPPC permit conditions compliance are listed and persons held to account. **Procedures used or action taken by the operator in the event of non-compliance** In the event of non-compliance, there is initial communication to the HSE department. The competent authority would be informed as soon as practicable and corrective actions would be implemented, which may include emergency response. Action reports, including root-cause analysis are developed and key management roles briefed. Preventative actions will be implemented where necessary.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The inspectorate department of the competent authority conducts on-site inspections. There has been 1 inspection since March 2008 and 3 visits from the local authority responsible for compliance with water discharge limits. Typically, the inspectorate would undertake 1 major audit per annum with minor audits where necessary or in response to non-compliance. Both the operator and competent authority highlighted that the operator is required by law to cooperate and provide assistance as may be necessary to the inspectorate.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Results of monitoring are available upon request.

Key observations from this case study assessment

Many of the permit conditions required by Article 3 are contained within the permit and the assessment has shown that, in the majority, the permit has been issued in accordance with the requirements of the IPPC Directive. There are however a few key exceptions including setting ELVs that are not based on BAT and failing to issue a permit ahead of the 30th October 2007 deadline. The following conclusions have been drawn on this case study:

- There is a single IPPC permit covering the main refining activities at the installation. This permit was issued after the deadline of 30th October 2007. There are separate permits covering chemical manufacturing processes that take place within the installation, which were not within the scope of this review.
- The application contained all the key elements required by Article 6. The operator also produced a comprehensive BAT comparison that considered existing processes and equipment in light of other techniques/technologies given within the BREF on mineral oil and gas refineries.
- The permit as assessed is a comprehensive document containing a mixture of general and specific conditions that fully meet the requirements set out in Article 3(a)-(f) of Directive 2008/1/EC.
- Where the determination process has shown the installation is not currently using BAT, the permit contains specific improvement conditions that require the operator to implement measures based on BAT.
- ELVs have been set for all sources of air and water emissions. The basis for setting these ELVs has been Ministerial Decisions that transpose European legislation into Greek national law. The ELVs for the large combustion plant units have been set directly using values from the LCP Directive 2001/80/EC. The remaining air emissions are covered under a refinery bubble, which in the absence of clear BAT-AELs, has been set using the LCP Directive values although not all plants covered by it are LCPs. The concept of local environmental conditions and economic viability of the operator has been incorporated into decision making by the competent authority when determining the suitability of these ELVs to be sufficient to avoid any significant environmental effect. (As described above, the consideration of the operator's economic circumstances in setting permit conditions may not be in accordance with the Directive.)
- An assessment of the key requirements of Article 3 shows that, with the exception of ELVs, the permit conditions are based on BAT and offer a high degree of protection to the environment as a whole.
- The permit contains, within the terms of an improvement programme, equivalent technical parameters for the Sulphur Recovery Unit, Sour Water Strip System and quality of refinery gas (maximum H_2S concentrations).
- The permit includes a series of detailed conditions requiring the operator to monitor emissions. The measurement method, frequency and evaluation process are specified or references made to the relevant national laws. The permit conditions oblige the operator to produce and submit reports on defined frequencies (monthly/annually).
- The permit has a suitable period of validity (5 years) and there was evidence that the permit, application and monitoring records are available to members of the public upon request.
- For those emissions where a comparison has been possible, the installation has demonstrated compliance with permit ELVs.
- Where it was possible to make a comparison with BAT-AEL values for key pollutants, the performance of the installation with regard to SO_2 was, in 2007, significantly above the upper BAT-AEL value of 850mg/m^3. In the absence of more recent data (data for 2008 were not available when the site visit and assessment were undertaken), it has not been possible to judge the extent to which permit improvements have reduced the level of emissions from the installation.
- The permit contains conditions that require the operator to develop and implement a site closure plan. The operator indicated that this plan is presently being drafted and will be submitted to the competent authority for approval.
- The inspectorate department of the competent authority conducts on-site inspections. There has been 1 inspection since March 2008 and 3 visits from the local authority responsible for compliance with water discharge limits. The typical level of inspection would be once per annum and this is supported by reviews of monitoring records to ensure compliance.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Permit for all non-LCP point source process emissions (Bubble Point)									
Refinery Bubble	Particulates	No Data	80 mg/m^3	No BAT-AELs	Unknown	N/A	Periodic	Av monthly value	101.325kPa O_2 (as measured) 273K
	SO_2	1431 mg/m^3 (Note1) 2482 tonnes/yr	1700 mg/m^3		Yes				
	NO_x	375 mg/m^3 (Note1) 658 tonnes/yr	450 mg/m^3		Yes				
	VOC	286 tonnes/yr	No specified limit		Unknown				
LCP									
MEK F101 (64.5 MW)	Particulates	No data	100 mg/m^3	5-20 mg/Nm^3	Unknown	Unknown	Continuous Emissions Monitoring System (from 2010 onwards). Current monitoring is periodic.	Monthly mean of half-hour measured value (BREF is daily average) (note5)	101.325kPa 0°C 3% O_2
	SO_2	2607 mg/m^3 (note2) 1227 tonnes/yr (note2)	1700 mg/m^3	50-850 mg/Nm^3	No	No			

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	NO_x	435 mg/m^3 (note2) 205 tonnes/yr(note2	450 mg/m^3	20-50 mg/Nm^3 (Gas) 55-300 mg/Nm^3 (Liquid)	Yes	No			
MEK SG931/941 (64.65 MW)	Particulates	No data	50 mg/m^3	5-20 mg/Nm^3	Unknown	Unknown	Continuous Emissions Monitoring System	Monthly mean of half-hour measured value (BREF is daily average) (note5)	101.325kPa 0°C 3% O_2
	SO_2	1484 mg/m^3 (note3) 621 tonnes/yr(note3)	1700 mg/m^3	50-850 mg/Nm^3	Yes	No			
	NO_x	427 mg/m^3 (note3) 179 tonnes/yr(note3)	450 mg/m^3	20-50 mg/Nm^3 (Gas) 55-300 mg/Nm^3 (Liquid)	Yes	No			
MEK F1400 (70.84 MW) – New LCP	Particulates	No data (Note 4)	50 mg/m^3	10-40 mg/Nm^3	N/A	N/A	Continuous Emissions Monitoring System	Monthly mean of half-hour measured value (BREF is daily average) (note5)	101.325kPa 0°C 3% O_2
	SO_2		850 mg/m^3	50-850 mg/Nm^3	N/A	N/A			
	NO_x		400 mg/m^3	20-50 mg/Nm^3 (Gas) 55-300 mg/Nm^3 (Liquid)	N/A	N/A			

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Sulphur recovery									
Sulphur Recovery Unit F652	H_2S	96.88% (2007) (99.2% in 9/2008)(Note 6)	99% removal efficiency 10mg/m^3 (in incinerator flue gas)	20-150 mg/m^3	Yes (from 2008)	Yes	Continuous Emissions Monitoring System and periodic laboratory analysis	Monthly mean of half-hour measured value (BREF is daily average) (note5)	101.325kPa 0°C 3% O_2
Flare stack									
	Smoke	<1	Ringelmann Shade 1	N/A	Yes	N/A	Visual		
VOC Recovery unit									
	VOC	5.2 grammes/m^3	35 grammes/m^3	N/A	Yes	N/A	Continuous Emissions Monitoring System	Hourly average value	101.325kPa 0°C 3% O_2

Notes:

1. Figures reported for 2007 (old permit), the figures reported here includes all point sources, LCP and non-LCP. From January 2008, LCP units are covered and reported under separate ELVs
2. Figures reported for 2007, ELVs valid from 1/2008 (NECD).
3. Figures reported for 2007.
4. The unit is still under construction.
5. Whilst there are some differences in averaging periods between the permit and the BREF, the full data-sets are made available to the Competent Authority during the annual submission of environmental reports.
6. Spot sample measurement reported by the competent authority – unconfirmed result.

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to water									
Liquid process wastewaters	BOD	23.1 (note 7)	60 mg O_2/l	2-20 mg/l	Yes	No	Continuous monitoring using composite samples over a 24 hr period <u>or</u> 3 spot samples inside 24 hr period (2 hrs apart)	Daily average values (BREF states monthly averages)	Not given
	COD_{cr}	174 (note 7)	180 mg O_2/l	30-125 mg/l	Yes	No			
	Suspended Solids	16.9 (note 7)	70 mg/l	2-50 mg/l	Yes	Yes			
	Total hydrocarbon	7.2 (note 7)	12 mg/l	0.05-1.5 mg/l	Yes	No			
	Phenol	0.1 (note 7)	0.5 mg/l	No BAT-AEL	Yes	N/A			
	Ammonia	2.6 (note 7)	35 mg/l	No BAT-AEL	Yes	N/A			

Notes:

7. Reported annual average value for year 2007 based on 24 hour average samples.

4.7.8 Case study 7 – Italy

This installation has not been included in the study because the permit was not issued in time.

4.7.9 Case study 8 – Netherlands

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 03/NL/07. The information in this table is based on the detailed assessment for this installation in Appendix F8. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is a mineral oil and gas refinery with the following units: • Unit Refinery Distillation and Utilities (RDU) comprise crude distiller, desulphurisation (hydrogenations of light or heavy fuel) and a platformer (desulphurisation of naphtha). • The Refinery Conversion and Treating (RCT) unit consists of high vacuum distillation units, a catalytic cracker, an alkylation unit, desulphurisation and sulphur recovery units and a hydrogen manufacturing unit. • The Refinery Special Products (RSP) department contains a Propane de-asphalting installation, furfural extraction units, MEK dewaxing and wax hydro finishing unit, hydroconversion (HYCON). • The Refinery Hydro- and thermal cracking, residue gasification and Powerplant (RHP) comprises the hydrocracker, the gasification hydrogen plant and the thermal cracker. The plant has a capacity of 19,500,000 tonnes of crude oil per year and a Nelson complexity index of 7.7.
Type of permit / issue date	The permit was issued on 22nd December 1993 as a result of a substantial change (extension with a hydrocracker and connected gasification hydrogen process). As a result of an IPPC- compliance check performed in August 2007, the company has to make a number of adjustments in order to achieve full compliance with the Directive. These adjustments have been scheduled for the next shut-down.
Basis of BAT determination	For the refineries, the Netherlands have provided a guidance note for refineries (*oplegnotitie*, which is part of the national legislation (NeR)) which describes the way the BREF-document is to be implemented and interpreted by the authorities. To keep a harmonised approach for the different regions in The Netherlands, the CAs have developed: • a book with standard prescriptions (regional prescriptions are added to national prescriptions); • a website (developed on the national level – Infomil) where companies can ask questions, announce changes, exchange points of view and consult up to date information. There is a national authority (VROM) responsible for the harmonisation of permitting in the different provinces.
Permit application	
Requirements of Article 6	The permit application, although drawn up prior to the implementation of the IPPC Directive contains all information required by Article 6, with the exception of a discussion of the main alternatives and the measures to be taken upon definitive cessation of activities.

Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The permit conditions do not include measures on waste avoidance, recovery and disposal, and site closure measures. All other Article 3-requirements are covered in the permit conditions.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	Total yearly emissions (expressed in tonnes/year) have been limited for SO_2, NO_x, VOX and dust. More stringent total yearly limits for SO_2 and NO_x have been recently established. Concentration limit values have been set for the catalytic cracking unit, the largest heaters and the sulphur recovery unit. Average and maximum concentration limit values have been established for the pollutants COD, BOD, Kjeldahl-N, total P, oil and phenols for the central wastewater treatment plant. A total daily or yearly emission limit for most of these pollutants has also been imposed. For some pollutants, there is a program of gradually setting more stringent ELVs over time. A program of gradually setting more stringent ELVs for total oil discharge to water is part of the permit.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** As the permit dates from 1993, BAT could not be taken into account. The permit adopts the use of bubble values for the key air pollutants and as such, direct comparison with BAT-AELs has not been possible. The setting of a more stringent total emission limit for SO_2 is based on BAT. The operator has also provided an assessment of BAT to the authorities in 2007. The information from the IPPC compliance check did not form part of the re-issued permit. The waste water which is treated in the WWTP, is derived from the chemical plant and the refinery, so the BAT-AELs can not readily be compared with the permit ELVs. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** An EIA has been made for the permit application, so the effects on the local environment have been taken into account in the permitting procedure. The more stringent limit values on oil discharge with refinery waste water have been based on a modelling study assessing the oil content in the sediments of the docks due to this discharge. The air quality limit value (air quality standard) for SO_2 in the area is exceeded and as a consequence the competent authority indicated that SO_2 emissions from the plant had to be reduced. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** No
Use of relevant BREF documents in setting permit conditions?	As the permit was granted in 1993, BREF documents could not have been taken into account. The operator submitted a BAT assessment to the Competent Authorities in 2007. Based on this assessment, a number of additional measures are/will be implemented over the coming years.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Yes. This includes measurement methodology and frequency (based on standards (NEN-ISO)); evaluation process (emission factors are fixed by Concawe or TNO); and an obligation to supply data to the Competent Authority. **Are the monitoring requirements sufficiently detailed?** Yes. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** As the permit dates from 1993, BAT could not have been taken into account. **Does the permit include information on duration in relation to monitoring requirements?** Yes

Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Yes
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** On 1st December 2005, the GBRs 'Mlieubeheer ' (2003) and 'Verontreiniging oppervlaktewateren" were modified in order to comply with the IPPC Directive. By this modification, the framework for granting permits is adapted to the Directive.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The air quality limit value (air quality standard) for SO_2 in the area is exceeded, so SO_2 emissions from the plant had to be reduced.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit does not have an expiry date. The CA confirms that the permits of installations with IPPC-activities are revised at least every 4 years.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The permit application, EIA and preliminary permit were subject to public participation for a 1 month period. The final permit was also subject to public participation for a 1 month period. **Are monitoring records made available to the public?** There is a specific permit condition that the company has to make its monitoring results of the previous year public by the 1st of August. Monitoring data for individual companies are available on a public website.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	85% of the NOx emissions are measured while the remaining 15% is calculated by correlations. There is continuous monitoring of SO_2 and dust on the catalytic cracker regenerator and continuous monitoring of SO_2 on the heaters. The monitoring frequency of the water emissions is fixed in the 'water treatment policy' of the company.
Operator's compliance with monitoring conditions	The emission monitoring complies with permit conditions.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	As a result of the IPPC compliance check in August 2007, more stringent ELVs to air will apply for the pollutants SO_2, NOx, PM10 and VOC as from 2010 onward.
Current emissions of key pollutants	This information is provided within the table below.

Assessment of Installation performance against BAT	The IPPC compliance check in August 2007 led to a number of minor issues that were found not to be in line with BAT, which are expected to be solved in the near future. The installation is compliant with the limits set within the permit based on data that have been made available. However, insufficient monitoring data have been provided to allow an assessment to be made of performance against the permit (the emission monitoring data do not cover all of the points listed in the permit). The use of bubble values within the permit also prevents a direct comparison with BAT-AELs.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The measures to ensure that the soil condition is returned to a satisfactory state are fixed in national legislation. The company has to request a permit to demolish an installation. In such a permit, there are several conditions to ensure the site is returned to a satisfactory state.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** • Review of monitoring reports • On site inspections • 4-monthly meeting between the CA and the operator **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** So far, the CA has only issued enforcement letters to urge the company to settle some minor non-conformities. In case of major non-conformities or not taking actions to resolve minor non-conformities, a judicial procedure can be started against the operator. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** • Internal audits and inspections • Regular conferencing with CAs • Good monitoring and follow up of ELVs **Procedures used or action taken by the operator in the event of non-compliance** Investigation of the event and taking the necessary measures to prevent future non-compliance. If the problem can not be solved immediately, a dialogue with the CA is started to set up an action programme.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The CA visits the site ca. 25 times/year for audits and inspections. The basis for determining inspection frequency is not known.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** There is a specific permit condition that the company has to make its monitoring results of the previous year public by the 1st of August.

Key observations from this case study assessment

As a result of an IPPC compliance check performed in August 2007, the company announced a few modifications in order to achieve full compliance with the BREF. Although the modifications should have been implemented before the 30 October 2007, the implementation of some measures is foreseen in the near future. This is due to the fact that the company is bound by its turnaround periods to implement modifications. After 2010, the operator will have implemented several measures to improve the performance of the installations,

The company conducts an intensive and open dialogue and feels that there is a close co-operation with and between the CAs. During the permitting procedure, the operator organised regular discussion meetings with both CAs, to make sure the application comprises all the necessary information. For setting the permit requirements and ELVs, the CA applies 2 principles: a high level of environmental protection (taking regional problems into account), and the site has to be in line with BAT. As a result of this approach, all the necessary items have been taken up into the permit.

The Netherlands provided a guidance note for the refinery sector, which facilitates implementation and interpretation of the BREF documents by CA and operator. To ensure a harmonised approach, the CA has developed standard prescriptions and a website. Furthermore, a national authority (VROM) is responsible for harmonisation of permitting in different provinces.

As the permit dates from 1993, BAT could not be taken into account. The setting of a more stringent total emission limit for SO_2 is based on BAT. The operator has also provided an assessment of BAT to the authorities in 2007.

The waste water which is treated in the WWTP, is derived from the chemical plant and the refinery, so the BAT-AELs can not readily be compared with the permit ELVs.

Emissions monitoring data have not been provided that allow a full comparison of actual performance against permit ELVs. For the data that have been provided, emissions are within the permit ELVs. As the permit sets limits for key air pollutants that are based on the bubble value approach, a direct comparison with BAT-AELs has not been possible.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?[1]	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Bubble	SO_2	17,880 tonnes/yr	19,600 tonnes/yr	N/A	Yes	N/A	/	Year	N/A
		921 t/Mt		N/A		N/A	Own calculation based on nameplate capacity		
		16,670 tonnes/yr	17,800 tonnes/yr	N/A	Yes	N/A	/	4-year average	N/A
	NO_x	4,600 tonnes/yr	7,700 tonnes/yr	N/A	Yes	N/A	/	Year	N/A
		237 t/Mt		N/A		N/A	Own calculation based on nameplate capacity		
	VOC	2,934 tonnes/yr	3,350 tonnes/yr	N/A	Yes	N/A	/	Year	N/A
	Dust	1,365 tonnes/yr	2,090 tonnes/yr	N/A	Yes	N/A	/	Year	N/A
Emissions to water									
Central WWTP	COD	1,514 tonnes/year	5,800 tonnes/year	N/A	Yes	N/A	/	Year	/
		78 g/t		3 – 70 g/t 3 – 45 g/t		No	Own calculation based on nameplate capacity		

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?[1]	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
		125.44 mg/l	200 mg/l	30 – 125 mg/l	Yes	No	/	Average	/
		460 mg/l	500 mg/l	N/A	Yes	N/A	/	Maximum	/
	BOD	14.98 mg/l	20 mg/l	2 – 20 mg/l	Yes	Yes	/	Average	/
		110 mg/l	190 mg/l	N/A	Yes	N/A	/	Maximum	/
	Flow	25,929 m^3/d	35560 m^3/d	N/A	Yes	N/A	/	Average	/
		32,819 m^3/d	55200 m^3/d	N/A	Yes	N/A	/	Maximum	/
	Ptot	3.22 mg/l	4 mg/l	N/A	Yes	N/A	/	Average	/
		6.8 mg/l	7,5 mg/l	N/A	Yes	N/A	/	Maximum	/
	Temp	38.8°C	40°C	N/A	Yes	N/A	/	Maximum	/
Emissions to land									
Not applicable									

4.7.10 Case study 9 – Poland

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 03/PL/08. The information in this table is based on the detailed assessment for this installation in Appendix F9. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation consists of a mineral oil and gas refinery, also delivering raw materials to a petrochemical complex situated on the same site. The refinery consist of the following installations: • atmospheric distillation • vacuum distillation • naphtha reforming • isomerisation • alkylation • gasoil desulphurisation • vacuum gasoil hydrocracking • vacuum gasoil desulphurisation • catalytic cracking • hydrogen production • storage and distribution The petrochemical complex consists of the following installations: • sulphur recovery unit with aftertreatment • steamcracking (olefin production) • aromatics extraction • ethylene oxide production The plant has a capacity of 13,000,000 tonnes of crude oil and a Nelson complexity index of 5.8. The CHP is operated using non-conventional fuels (fuels that can not be sold as specified fuels on the market). The operator indicated that the CHP falls under the LCP Directive according to national legislation.
Type of permit / issue date	The issuing of the permit was linked directly to the implementation of the IPPC Directive in Poland. The permit is an integrated permit, covering most relevant impacts on the environment (air, waste, soil, noise) and safety issues. There is a separate permit for wastewater discharges because the competent authority is different. The permit was issued on 31 May 2005. Since the issuing of the permit, a number of modifications have been made to the plant, leading to the update of the existing permit. There is a separate permit for discharges of wastewater, issued by a different competent authority. Both permits (operating and wastewater discharge) are issued without coordination between the competent authorities involved.

Basis of BAT determination	For setting ELVs, there is a general fallback on national legislation that take the form of GBRs, which for certain activities (e.g. large combustion plants, waste incineration plants) is the legislation implementing EU legislation. A number of ELVs, especially for air and noise, also refer to meeting the quality standards at the border of the terrain owned by the plant and is also subject to monitoring. EU BREF documents are said to be used for the determination of BAT. For some sectors, these BREF documents have been translated into Polish and for others not. A nationwide uniform interpretation of the BREF documents is reported to be guaranteed by providing training to the local competent authorities responsible for the issuing of permits. In case there is doubt on the interpretation of BAT, assistance can be given by experts from the Ministry of Environment. According to the operator, the definitions of the best available techniques are provided in Article 3 of the Environment Protection Law and that, neither in the Polish Law nor in the IPPC Directive, are the BREF documents treated as sources of standards obligatory for the installations, but rather as guidelines and documents supporting the determination of the BAT for a given installation at a given location. Although national legislation specifies that all processes should be based on BAT, there is no clear indication that permit conditions are based on BAT as defined in the BREFs.
Permit application	
Requirements of Article 6	The permit application meets all of the requirements of Article 6 with the exception of the consideration of the main alternatives. According to the operator, a description of the main alternatives is not relevant for existing installations.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** All requirements of Article 3 of the Directive have been considered in the permit.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	In relation to emissions to air, emission limit values are set for the individual stacks (mostly combustion processes in heaters and furnaces) and for the total yearly discharge for refinery, petrochemical plant and boilers individually. There is a variety of concentration-based and mass-based limits as set out in detail in Appendix F9. The IPPC permit only sets limit values for the WWTP influent. Emission limit values for the discharge are set in a separate permit for wastewater discharge, that has also been considered.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** Although national legislation specifies that all processes should be based on BAT, there is no clear indication that permit conditions are based on BAT as defined in the BREFs. After review of the draft assessment report, the Competent Authority added that both the application and the permit are based on the BREF documents, but in the case of analysis of the application as well as in the case of modification of the provisions of the permit, the requirements determined in the Polish regulations were followed. After review of the draft assessment report, the operator added that the BREF documents are not applicable standards either in the Polish law or in the IPPC Directive. They are treated as documents supporting the determination of the BAT for a given installation. The conditions for setting the techniques for the installation were analysed in the application for an IPPC permit in conformance with the requirements mentioned in the Polish Environment Protection Act. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** In addition to emission limit values, the permit also clearly states that ambient air quality standards and noise limit values need to be met at the border of the terrain owned by the plant. In this way local environmental conditions are indirectly accounted for.

	Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)? No
Use of relevant BREF documents in setting permit conditions?	There is no clear indication that permit conditions are based on BAT as defined in the BREFs. After review of the draft assessment report, the competent authority added that both the application and the permit are based on the BREF documents, which is demonstrated in the regulations provided in the justification for the IPPC permit. In the case of analysis of the application as well as in the case of modification of the provisions of the permit, the requirements determined in the Polish regulations were reported to have been followed (a full review of the national legislation has not been undertaken for this study).
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** Monitoring methodology and frequency for emissions to air and water (influent to the WWTP) and for noise are accurately described in the permit. Monitoring of ambient air quality and noise is also a permit condition. Monitoring requirements for discharges to water are described in the permit for wastewater discharge. **Are the monitoring requirements sufficiently detailed?** Yes **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** No **Does the permit include information on duration in relation to monitoring requirements?** Yes
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	The permit does not contain such conditions.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes, the setting of ELVs is based on GBR. These are used to set conditions within the permit and are set out directly in the permit itself.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** According to national legislation, in cases where BAT does not allow the EQSs in the vicinity of the plant to be met, than stricter technical standards than those achievable by the use of BAT have to be applied. However, stricter standards have not been applied in this case.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit of this installation has to be reconsidered every 5 years. The permit will also be reconsidered if the operator wishes to make a substantial change to the installation.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/decision document and permit available on a public register?** The permit application is accessible to the public in the main office of the competent authority. **Are monitoring records made available to the public?** Monitoring records are available upon request. However, certain monitoring data provided to the competent authority by the operator are not available to the public.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	According to the operator, all monitoring is performed according to permit conditions and national GBR. The competent authority for inspection does regular checks on the monitoring procedures of the company and confirms that procedures are in line with permit conditions and national GBR. The actual monitoring has not been assessed for the purposes of this study.
Operator's compliance with monitoring conditions	According to the operator, all monitoring is performed according to permit conditions and national GBR.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	No data have been provided on emissions prior to implementation of the IPPC permit. The operator indicated that, prior to issue of the IPPC permit, the operator had to comply with sector-level decisions on the permissible emissions to air, a permit for waste generation, a permit for water consumption and wastewater discharge (and observance of the provisions of these permits was subject to inspections performed by competent authorities).
Current emissions of key pollutants	This information is provided within the table below and in more detail in Appendix F9. Based on the monitoring data provided, all of the emissions monitored are below the permit-ELVs and within the range of the BAT-AELs, where applicable.
Assessment of Installation performance against BAT	The monitoring data provided for the purposes of this assessment include: monitoring data for individual stacks provided by the competent authorities for inspection; yearly loads for 2007 provided by the operator; and monitoring data for discharges to water provided by the competent authorities for water. In relation to emissions to air, the majority of permit ELVs for the refinery are within the BAT-AEL ranges for liquid fuels. However, permit ELVs for the boilers are all set higher than the upper end of the BAT-AEL ranges for NO_x, SO_2 and PM_{10}. In both cases, the permit ELVs are all based on yearly averages whereas the BREF BAT-AELs are mainly daily averages. Permit ELVs for emissions to water are generally within the BAT-AEL ranges, or in one case slightly higher (total N, where the permit ELV is 30 mg/l compared to the BREF BAT-AEL of 1.5-25 mg/l). In relation to both air and water emissions, the data provided suggest that emissions are below the permit ELVs and also within the BAT-AEL ranges for both air and water emissions. Concentration emissions data were only available for one stack for air emissions and the main comparison made in the table below relate to total annual mass emissions. Ambient air quality monitoring data also indicate that the ambient air quality standards in the vicinity of the plant have not been exceeded over the year 2007.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The permit does not deal explicitly with the cessation of activities although national legislation provides measures to be taken within the field of soil pollution.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The environmental inspectorate normally operates according to an inspection plan. Inspections can be either topic or unit oriented. Unplanned inspections (intervention controls) are also carried out but these are usually triggered by complaints. Inspections usually deal with the assessment of the correctness and completeness of monitored and reported data. Samples can be taken by environmental inspectors. This is often the case for wastewater but sampling of air emissions is less common, due to safety issues. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** The writing of a formal enforcement letter by the CA has been the most used instrument to settle minor non-conformance issues. In some cases environmental inspectors have given fines to operators responsible for the breaching of permit conditions. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** There are strict internal operating procedures for operators that also take into account environmental performance of the installations. Operators have access to continuous monitoring data (key process conditions and sometimes emission monitoring), allowing immediate corrective actions to be taken in case of exceedances. The company is ISO 9001 – 14001 – 18000 certified. **Procedures used or action taken by the operator in the event of non-compliance** Internal operating procedures take into account environmental issues and also provide for corrective actions in case of non-compliance..
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** Over the period 2006-2007 some 26 inspections (planned and unplanned) were carried out. It is unclear how inspection frequency is determined.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Monitoring records are available from the CA on request.

Key observations from this case study assessment
The permit not only sets emission limit values but also clearly states that ambient air quality standards and noise limit values need to be met at the border of the terrain owned by the plant. In this way local environmental conditions are indirectly accounted for. There seems to have been no co-ordination with the competent authorities for wastewater discharge during the IPPC permitting procedure (see Appendix F9 for further details). Although national legislation specifies that all processes should be based on BAT, there is no clear indication in this case that permit conditions are based on BAT as defined in the BREFs. According to the operator, all monitoring is performed according to permit conditions and national GBR. The competent authority for inspection does regular checks on the monitoring procedures of the company and confirms that procedures are in line with permit conditions and national GBR. Actual monitoring has not been reviewed for the purposes of this study. Based on the monitoring data provided, all of the emissions monitored are below the permit-ELVs and within the range of the BAT-AELs, where applicable and where data have been provided see the table below and further information in Appendix F9 (where further data are available). For air emissions, the majority of the data provided only allow for a comparison to be made with the permit ELVs for total annual emissions. Concentration-based data were only available for an individual stack, where NO_2 and SO_2 emissions data suggest emissions below the permit ELV and within the BAT-AEL range. Mass-based emissions data were made available for the total refinery, total petrochemical plant and total boilers, with reported emissions all below the permit ELV values. For water emissions, data were made available on emissions of 17 pollutants. All of the reported data suggest emissions below the permit ELVs with emissions for the four pollutants where there is a BAT-AEL (COD, suspended solids, total N and NH_4-N) also within the relevant BAT-AEL ranges.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Individual stack	SO_2	< 1.4 mg/Nm^3	7.5 mg/Nm^3	5 – 20 mg/Nm^3 (gaseous fuel) 50 – 850 mg/Nm^3 (liquid fuel)	Yes	Yes	GBR (Method PB/PPT/08)	Average of 2 half hourly averages	101.3 kPa 273 K 3% O2 dry
	NO_2	5.9 mg/Nm^3	30 mg/Nm^3	20 – 150 mg/Nm^3 (gaseous fuel) 55 – 300 mg/Nm^3 (liquid fuel)	Yes	Yes	GBR (Method PB/PPT/08)	Average of 2 half hourly averages	101.3 kPa 273 K 3% O2 dry
Total refinery part	SO_2	1,394.90 tonnes/year	2,402.61 tonnes/year	N/A	Yes	N/A	Not specified	Not relevant	Not relevant
	NO_2	534.05 tonnes/year	1,218.86 tonnes/year	N/A	Yes	N/A	Not specified	Not relevant	Not relevant
Total boilers	SO_2	18,369.50 tonnes/year	21,567.9 tonnes/year	N/A	Yes	N/A	Not specified	Not relevant	Not relevant
	NOx (as NO_2)	4,854.00 tonnes/year	7,992.80 tonnes/year	N/A	Yes	N/A	Not specified	Not relevant	Not relevant

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	PM10	542.88 tonnes/year	1,268.70 tonnes/year	N/A	Yes	N/A	Not specified	Not relevant	Not relevant
Notes: Monitoring from individual emission sources is performed according to national standards and use is made of the average of two half hourly average values. Sampling/measurement time and reference conditions are "not relevant" for yearly total emissions which have to be calculated from the available monitoring data. Whilst various concentration-based ELVs have been set in the permit, monitoring data to determine whether emissions are in line with these ELVs have not been reviewed and the above assessment therefore relates to whether total annual mass emissions are in line with the permit ELVs. BREF specifies continuous monitoring.									
Emissions to water									
	COD	47.8 mg/l	125 mg/l	30 – 125 mg/l	Yes	Yes	PN-74/C-04578/03	Average of 3 spot samples taken within 1 hour	Not relevant
	SS	7.8 mg/l	35 mg/l	2 – 50 mg/l	Yes	Yes	PN-EN 872:2007	Average of 3 spot samples taken within 1 hour	Not relevant
	Total N	2.73 mg/l	30 mg/l	1.5 – 25 mg/l	Yes	Yes	PB/PA12:2006	Average of 3 spot samples taken within 1 hour	Not relevant
	NH_4-N	0.98 mg/l	10 mg/l	0.25 – 10 mg/l	Yes	Yes	PB/PA11:2006	Average of 3 spot samples taken within 1 hour	Not relevant
Notes: Averaging periods - the refineries BREF (Section 4.24.8) indicates that the concentration values have been reported for different averaging periods.									
Emissions to land									
Not relevant.									

4.7.11 Case study 10 – Slovakia

Assessment of permit determination procedures and permit conditions

<table>
<tr><th colspan="2">Introduction</th></tr>
<tr><td colspan="2">The unique reference number for this installation is 03/SK/09.
The information in this table is based on the detailed assessment for this installation in Appendix F10. Further information and elaboration on certain points is included in the detailed assessment.</td></tr>
<tr><td>Overview description of type of installation / application</td><td>The installation is a large refinery operating with an annual production capacity of 5.5 - 6 million tonnes. The installation contains a wide range of technologies for the production of gases, ultra-low sulphur motor fuels, lubricants, plastics and petrochemical products. The associated thermal and electrical power plant was built in 1961 with progressive changes through to a substantive retrofitting of all components by 2004.
The installation operates the following key facilities:

Section 1.1 A combustion installation with a rated thermal input exceeding 50 MW:

Total rated thermal input for main refinery boilers 692MW
Main boilers K1 (107MW), K2 (107MW). K3 (193MW) fired on refinery or natural gas (with 1% fuel oil option (operationally time-limited by the permit))
K7 (98MW) and K8 (98MW) boilers fired on heavy fuel oil (max 1% sulphur)
K11-14 (22.9MW each) boilers fired on natural gas
Centralised heating boiler with thermal input of 78.8MW

Section 1.2 Mineral oil and gas refinery installations:

Catalytic hydrocracking
Catalytic reforming
Hydrogen separation processes and Isomerisation
Vacuum distillation
Superfractionation and aromatics
Sulphur and asphalt production
Sulphur recovery units and flue gas desulphurisation

Section 4.1 (a) chemical installations for the production of basic organic chemicals such as simple hydrocarbons:

Refined petro-products including Euro-standard diesel;
Plastics production (polypropylene 3);
Reforming and redistillation of aromatic products

Section 4.1 (b) chemical installations for the production of basic organic chemicals such as oxygen-containing hydrocarbons:

Fluid catalytic cracking for refining of vacuum distillation products

Section 4.2 (b) chemical installations for the production of basic inorganic chemicals such as acids:

Sulphur production, nitrate solution regeneration, striping of acid water, sulphuric acid regeneration.

Section 5.1 Installation for the disposal or recovery of hazardous waste.
</td></tr>
</table>

Type of permit / issue date	There are 18 IPPC permits currently in force to authorise the activities undertaken at the installation. An additional 10 permits have been issued to cover the construction, upgrading and operational changes in the form of permit variations. The focus of this assessment has been on the key processes that give rise to the most significant environmental impacts associated with the installation, which are: ▪ Catalytic hydrocracking (permit issued 28.06.2006); ▪ Catalytic reforming (permit issued 21.08.2006); ▪ Atmospheric and vacuum distillation (06.06.2006); ▪ Fluid catalytic cracking (permit issued 11.04.2006); ▪ Sulphur recovery units (permit issued 01.03.2006). The permits were issued under transitional arrangements and are of an integrated nature, covering aspects of air, water, land, raw materials, waste, energy, soil protection, accidents, monitoring requirements and other technical operation parameters.
Basis of BAT determination	The key piece of information relied upon in the determination of BAT is the IPPC Act 245/2003, specifically paragraph 5 and Annex 3. There is guidance on the Slovak Environmental Inspectorate (SIZP) website that BREF documents can form part of the process of IPPC permit determination. However the responses given by the inspector during interview indicated that the basis of the BAT determination (due primarily to pressures of time and resources) has been to trust the technical assessment made and submitted by the operator in their application. The submissions are compared against the ELV ranges given in the GBRs and where it is clearly evident that BAT is lower than the ELV upper range, a lower limit may be used by the competent authority with suitable justification.
Permit application	
Requirements of Article 6	The response made by the inspector was that the applications made by the operator were of a good standard with relevant information in each of the areas required by Article 6 supplied. Additional technical information requests were made during determination.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The competent authority were clear in their view that the steps required to determine an IPPC permit are clearly laid out in the national laws (within annex 3 of the IPPC Act and Component Laws on air, water and waste) and associated GBRs. The Ministry of Environment and Environmental Inspectorate provides guidance to operators to produce applications that contain the correct information in order to facilitate determination. The assessment of this installation has shown that conditions are included within the permit that governs the basic obligations of the operator according to Article 3. Each of the permits issued to the operator that govern processes undertaken at the installation are based on a template that ensures consistency. Whilst many of the permit conditions are generic, they have suitable cross-reference to GBRs and other regional legislative requirements (e.g. water).

Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	**Air:** ELVs have been set for all main pollutants for the key installation processes considered within the framework of this assessment (see Introduction). Many of the ELVs are explicitly stated in the permit however references to the GBRs that contain these limits values are also made within the competent authority decision given in the permit annex. No ELVs have been set (concentration or mass limits) for fugitive releases or for the flare. Conditions are in the permit requiring the operator to minimise the release of fugitive emissions (for example from storage) and those through flaring using BAT. A specific programme of leak detection and repair is in operation at the installation. **Water:** ELVs are set for the main pollutants emitted from the treatment of process and sanitary wastewaters arising from the installation. The ELVs are set using GBRs referenced within the permit and administered by the District Environmental Office, not the Slovak Inspectorate. In order to ensure full integration in the IPPC permit, conditions are placed in the permit requiring the operator to comply with the discharge parameters and limits given by the GBR. **Protection of soil and groundwater** No ELVs have been set. **Waste** Several conditions relate to the GBR 223/2001 Z.z. on management of wastes and conditions in the permit require the operator to minimise wastes and recover them where practicable. **Transboundary considerations** It is understood that the procedure for taking into account transboundary pollution was done in accordance with Article 17. There is a section in the permits for conditions on transboundary impacts however there have been no specific conditions set for these permits. **Further equivalent technical parameters/measures** have been set for: The permits contain technical parameters for operation within Section A.2. In all permits there is a generic condition on the operator to ensure adequate technical control of the relevant processes. In addition to this, in several permits operational parameters such as level of continual operation and specific limits for non-operation (e.g. for maintenance).
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** The assessment shows that whilst some of the limits in the permit are set within the BAT-AEL ranges, many are set above. The competent authority noted in responses that the ELVs are set via central GBRs and the compliance with these is implicit within Slovakian law. These ELVs are evaluated by the Ministry of Environment on an undetermined basis in accordance with wider issues of sectoral priorities and local/national air quality issues. The competent authority has the power to set stricter limits but quite often do not choose to for the reason that the operator may challenge and would be legally able to do so. **Vacuum and Atmospheric Distillation Units** There are no clear BAT-AELs within the BREF document to be able to compare permit ELVs to. The conditions set in the permit to ensure the operator utilises BAT are commensurate with the specific requirements set out in the BREF document in 5.2.19 on page 411. **Hydrocracking** ELVs set for particulates, are within BAT-AEL ranges. The NO_x limit of 200 mg/m^3 is above the BAT-AEL for an installation using primary and secondary pollution abatement (SCR). The SO_2 limit of 37mg/m^3 (natural gas) or 100mg/m^3 (refinery gas) is above the BAT-AEL of 5-20mg/m^3 when using refinery gas fuel. **Catalytic reforming** There are no clear BAT-AELs within the BREF document to be able to compare permit ELVs to. It has not been clearly possible to identify that conditions set in the permit requires the operator to utilise BAT techniques that are commensurate with the specific requirements set out in the BREF document in 5.2.6 on page 405. **Fluid Catalytic Cracking** The ELVs are set higher than relevant BAT-AELs. It was noted during the assessment that the permit

	dated 11.04.2006 has been since amended by a revised permit 10.07.2008 that changes the ELVs. Limits for NO_x have been raised from 500 to 700 mg/m^3, SO_2 from 500 to 1700 mg/m^3 and particulates from a mass-flow tier limit (50-150 mg/m^3) to a flat 50 mg/m^3 under all conditions. The reasons given for these limits being changed relate to changes to the GBR 706/2002 Z.z. made by the Ministry of Environment. The operator has a legal obligation to comply with changes in the GBR and therefore the permit has been amended to reflect this. **Sulphur Recovery Unit** The ELVs set for this plant are higher in each case than the BAT-AELs specified in the BREF document in process-specific sections. The permit limit of 1% sulphur maximum concentration (based on volumetric flow) equates to a removal efficiency of 99%. The specific BAT given in the BREF document 5.2.23 (pp. 413) indicates that BAT is a staged SRU with a recovery efficiency of 99.5-99.9%. Given that this recovery unit has been installed for some time, the efficiency that it is achieving (99.3-99.5%) is good but not equivalent to BAT. **Thermal Power Station** The ELVs set for the thermal power plant are based on fuel input. Details of the ELVs are presented in the table at the end of this section. Using natural gas or refinery gas, the ELVs are set slightly higher than BAT-AEL ranges as given in the BREF document 5.2.10 (pp. 408-9). The limits are below those set within the LCPD Directive. When the power plant is operating using heavy fuels, the ELVs set are not commensurate with BAT-AELs. Assessment of the emissions profile from monitoring results shows that the typical level of emissions are in line with permit emissions limits however the ELVs as defined within the GBR cannot be regarded as being BAT for the thermal process. A number of the site's main boilers have been retrofitted with SNCR for abatement of NO_x emissions; however it was not clear which ones during the meeting as the technical expert was not present due to illness. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** The limits set in the permit are transposed directly from GBRs. It has not been possible within the bounds of this assessment to analyse individual GBRs to assess to what extent local factors have been taken into account however it is clear that a framework does exist for enabling this. It is not clear from the assessment how specific technical characteristics of the installation are taken into account when setting ELVs within the GBRs. The installation is subject to significant regulatory scrutiny having its location in close proximity to a major conurbation. Continuous monitoring is required of the ambient air quality around the site boundaries and within the surrounding neighbourhoods and this represents an example of geographic location influencing permit conditions. **Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?** None observed. **Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)?** None observed.
Use of relevant BREF documents in setting permit conditions?	The operator noted during the assessment that the BREF documents provided a significant technical reference for the installation's technical department when determining appropriate measures in accordance with BAT. The competent authority did not explicitly use the BREF document in determination of the permit conditions nor is any reference to it made in the decision.

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permits contain a significant number of conditions that cover monitoring of emissions to air, water and arisings of waste plus the continuous assessment of air quality surrounding the installation. These cover the frequency of the monitoring that is required. The methods that must be used by the operator are clearly stated in each permit in a table within Section I. Different methods of monitoring are provided for periodic and continuous monitoring. An assessment of whether this monitoring meets the requirements of the LCP Directive has not been conducted. Conditions in Section I also require the operator to provide the results of the monitoring data to the competent authority at a specified frequency and to produce a report to be submitted on an annual basis on the 15th February each year. The permit does not include reference to specific standards for monitoring although reference is made to GBRs that determine which standards are applicable to each pollutant to be monitored. **Are the monitoring requirements sufficiently detailed?** The monitoring requirements appear to be sufficiently detailed, covering all the key pollutants and are set in each permit for the major emission sources. In some cases, reference is made to the standards of monitoring given in GBRs. **Do the monitoring requirements take into account the details contained within the BREF documents?** It is not clear from the assessment how the BREF has been adequately taken into consideration in setting the requirements for emissions monitoring. Monitoring standards can be set centrally by the Ministry of Environment in GBRs and these have not been individually assessed. **Does the permit include information on duration in relation to monitoring requirements?** In some specific cases, this information is included (e.g. water emissions monitoring) however the assessment shows variation between permits regarding provision of the monitoring duration.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	Yes, specific conditions relating to non-normal operation are given in Section H. Typically, these are generic conditions requiring the operator to develop and if necessary, implement the plan to reduce the potential risk of environmental pollution caused from abnormal or fault conditions. The permit conditions then require the operator to use the techniques proposed in the plan (which may be made with the application).
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** Yes. MŽP SR č.706/2002 Z.z. is used to set the ELVs for permits and contains strict limits according to categories of industrial activities. MŽP SR č.1/2003.z and MŽP SR č.408/2003 relate to the requirements that the operator must follow with regard to conducting emissions monitoring.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** The permits make reference to the requirements that the operator should ensure that all limits for local air quality, specified within a general binding rule, shall be met. This requires the operator to monitor ambient air quality at several locations within and beyond the site boundary to ensure compliance with these standards. Compliance with water quality standards are ensured through the setting of specific limits on discharges made to surface waters, which are under the control of the district environmental office and enforced through key reference within the permit for the wastewater treatment plants. It is understood from discussion that no further conditions beyond BAT have been necessary in order to achieve compliance with EQSs.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	IPPC permits are valid for a maximum period of 8 years from issue date and permissions related to water emissions are valid for only 3 years, after which time the operator must re-apply to the competent authority.

Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes, the application is available upon request. Since 2005, the IPPC permits and subsequent amendments are available from the website of the Slovak Environmental Inspectorate in electronic downloaded files. A list of these can be viewed here> http://www.sizp.sk/ IPKZ > Integrované povolenia > Vydané integrované povolenia. Paper copies of permits are available from district offices upon request. **Are monitoring records made available to the public?** Monitoring records are understood to be available from the Inspectorate upon request although it is not clear how accessible these records are. The operator makes monthly publications of the environmental emissions and local air quality monitoring results on their website in accordance with the requirements of Law 211/2000 on free access to information. Live feeds of the ambient air quality are broadcast in the company reception and reported on the information notice board for the public to view.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	For the key permits that have been assessed, continuous monitoring is undertaken by the operator for the main air emission points with the exception of the Hydro-crack plant, Atmospheric Distillation plant and Atmospheric Vacuum Distillation plant, which is monitored periodically at a frequency of 3 years (main AD5 AVD6 points) and 6 years (other emission points). The operator uses an internal monitoring division to undertake management and carry out monitoring as required. The monitoring division is approved by the Ministry of Environment to undertake monitoring of both this and other installations under commercial contracts. **Air emissions** The permits authorise the use of a wide range of monitoring techniques applicable to the specific pollutant to be measured. Monitoring standards are given in GBRs, which have not been individually assessed for this case study. **Water emissions** The key pollutant parameters for water emissions from the wastewater treatment plants are monitored continuously using the methods specified in Table A1.b. The methods of monitoring that must be used by the operator are presented in the permits. **Other** Monitoring of solid waste discharges and disposals is required and reported on a monthly basis. Energy consumption and water use is monitored. Monitoring of ground conditions and groundwater is also required on a periodic basis.
Operator's compliance with monitoring conditions	The use of continuous and periodic monitoring is in line with the requirements stipulated in the permits.

Installation performance

Emissions of key pollutants prior to implementation of the IPPC permit

Data on the level of emissions pre-IPPC has been taken from the publications made by the company on an annual basis (2007 report).

Mass Emissions – Air (t/year)

	NOx	SO2	PM10	VOCs	CO
2003	3,723	12,049	324	5.460	568
2004	3,865	9,673	306	4.754	707
2005	3,242	9.084	302	4,613	605
2006*	3,193	11,546	256	4,302	616

* IPPC permits introduced on key refinery processes from 2006 onwards

Mass Emissions – Water (t/year)

	TPH	COD	BOD_5	SS
2003	22	1,373	284	1,351
2004	17	992	214	743
2005	15	1,146	222	657
2006*	25	1,176	218	600

* IPPC permits introduced on key refinery processes from 2006 onwards. TPH = total petroleum hydrocarbon.

Although specific consumption figures were not provided in all environmental reports, an assessment of the figures given above against production volumes demonstrates that the installation has made year-on-year reductions in specific emissions (i.e. kg/ton or g/ton) since 2001.

Current emissions of key pollutants

A comparison of recent monitoring data against permit ELVs and BAT-AELs has been made (where possible) in the table at the end of this case study. In order to provide a broader overview of environmental performance, the following mass emissions were reported by the installation:

Mass Emissions – Air (t/year)

	NOx	SO2	PM10	VOCs	CO
2006*	3,193	11,546	256	4,302	616
2007	2,941	8,476	194	4,234	490

* IPPC permits introduced on key refinery processes from 2006 onwards

Mass Emissions – Water (t/year)

	TPH	COD	BOD_5	SS
2006*	25	1,176	218	600
2007	10	1,099	148	689

* IPPC permits introduced on key refinery processes from 2006 onwards. TPH = total petroleum hydrocarbon.

In order to gauge the impact that IPPC permits have had on installation performance, the figures above should be evaluated in the context that production volumes at the installation in 2006 were 4.86 million tonnes and in 2007, 5.32 million tonnes. This represents a production increase of almost 9.5%.

Assessment of Installation performance against BAT	In lieu of a full 12 months data (that was not provided), the assessment has been based on five months reported monitoring data from the continuous emissions monitoring systems and mass data provided by the site. These systems cover the major emissions however not all systems were live as some continuous monitoring systems were still being upgraded in accordance with the permit improvement programme at the time of monitoring. For those emission points where data has been available, the assessment demonstrates that the emissions from all major air and water discharge points comply with both the permit and all the BAT-AELs. The sulphur recovery unit and acid regeneration plant have data reported in both concentration based figures and recovery efficiency figures. On the basis that BAT for the SRU is >99.5%, the performance of the installation is slightly below BAT (99.4% and 99.3% reduction). When considering that the BAT conclusions (BREF on mineral oil and gas refineries, Chp 5.23 pp.413) indicate a concentration level of 400-2000 mg/m^3, the reported performance of the SRUs is well above the BAT-AEL. No additional desulphurisation techniques (such as FGD) are utilised on the sulphur recovery system.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The permit requires a closure plan to be drafted and submitted to the competent authority prior to final cessation of activities and planned closure of the installation. At present there is no requirement for this to be drafted in advance of closure and therefore a closure plan has not been developed by the operator. There was no clear evidence that measures were in place to return the site to a satisfactory state at cessation of activities.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the competent authority for ensuring compliance:** The competent authority has been granted the ability to access remotely the internal systems of the operator therefore gaining access to data and procedural logs that can be assessed to judge adequate compliance. This has been facilitated as the site produces a very wide range of data and reports and this allows the competent authority to plan assessment of compliance over a longer time period that during the submission of annual reports on environmental performance. The competent authority also conducts inspections and reviews the emissions reports and results of AMS monitoring outputs. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** There have been no sanctions taken by the competent authority as the operator has maintained compliance with permit conditions. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The operator highlighted that the company has a wide range of plant-specific operational procedures that include the aspects of environmental impact and protection of the environment. Automatic monitoring systems and plant-by-plant trend analysis ensures that any issues associated with performance will be picked up by the operational teams. The operator cited three specific operational regimes that are used: fire, safety and environment protection. The operational procedures are underpinning documents to these control regimes. An internal website provides access to all documents for operational staff and tests/drills are regularly conducted to test responses. **Procedures used or action taken by the operator in the event of non-compliance** The plant manager holds the responsibility to liaise with the environmental protection (EHS) department in order to coordinate their response to an incident that may potentially have a significant environmental impact. The internal procedures are fully specified in printed documents, role descriptions and in pocket handbooks.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** Inspections are undertaken that are both announced and according to the operator unannounced. There exists a law (71/1967) that requires all site inspections to be announced to the operator but it was not clear from the assessment that this is being followed in each case. The number of annual inspections in approximately 10. The operator offers support as necessary to the competent authority.

Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** The results of monitoring were reported by the competent authority to be available upon request however the assessment team had significant difficulties in obtaining copies of this data.

Key observations from this case study assessment

- There are 18 IPPC permits currently in force to authorise the activities undertaken at the installation. An additional 10 permits have been issued to cover the construction, upgrading and operational changes in the form of permit variations. This forms a significant administrative burden for the competent authority and has resourcing implications for compliance assessment.
- The operator made a number of applications, each one complying with the requirements of Article 6.
- Each of the permits issued to the operator that govern processes undertaken at the installation are based on a template that ensures consistency. The key conditions cover all aspects associated with Article 3(a)-(f).
- The basis of the BAT determination appears to have mainly been the technical assessment submitted by the operator in his application, rather than the relevant BREFs.
- ELVs have been set for all main pollutants for the key installation processes for water and air emissions. The ELVs have been set using GBRs.
- The ELVs that have been set in the permit are generally set higher than either the corresponding BAT-AEL (where applicable) and higher than the current emissions performance achieved by the technologies employed at the installation.
- The permits contain conditions that cover monitoring of emissions to air, water and arisings of waste plus the continuous assessment of air quality surrounding the installation. These conditions specify frequency and methods to be used. Monitoring standards must be followed and the permit references specific GBRs containing these standards for each pollutant.
- Both the application and permit are available to members of the public however there has been significant difficulty in acquiring a comprehensive set of annual emissions data from the public register (see Appendix F10 for further details).
- The performance of the installation (where an assessment has been possible) is within BAT-AEL ranges for all key process emissions to air and water. The SRUs achieve a recovery efficiency of 99.3-99.4%, which is below the BAT-AEL of 99.5-99.9% and sulphur emissions from the SRU are above the BAT-AEL upper value of 2000 mg/m^3. No additional desulphurisation (such as FGD) is utilised.
- There was no clear evidence that measures were in place to return the site to a satisfactory state at cessation of activities.
- Inspections are undertaken that are both announced and according to the operator unannounced. The number of annual inspections is approximately 10. The operator offers support as necessary to the competent authority.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Permit for Atmospheric Distillation (AD5) and Atmospheric Vacuum Distillation (AVD6)									
AD5 / AVD6 (Note 1)	Particulates	2.8 t (AD5) 0.2 t (AVD6)	5 mg/m^3	No BAT-AELs	N/A	N/A	Continuous Emissions Monitoring System (not active as yet)	Monthly mean of half-hour measured value	101.325kPa 0°C 3% O_2
	SO_2	0.339 t (AD5) 37.8 t (AVD6)	35 mg/m^3						
	NO_2	62.1 t (AD5) 74.0 t (AVD6)	200 mg/m^3						
	CO	20.8 t (AD5) 2.4 t (AVD6)	100 mg/m^3						
Catalytic Hydrocracking									
Furnaces: - Reforming - AVD - Recycled Gas - Reboiler	Particulates	1.4 t (furnaces B 101.101 and B103.101-104) 0.534 t (furnace B 102.301)	5 mg/m^3	10 – 40 mg/m^3	N/A	N/A	Continuous Emissions Monitoring System (not active as yet)	mg/m^3	Monthly mean of half-hour measured value

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
- Fraction - Recycled oil (Note 1)	SO_2	66.4 t (furnaces B 101.101and B103.101-104) 4.7 t (furnace B 102.301)	100[67] mg/m^3	10 – 350 mg/m^3					
	NO_2	28.3 t (furnaces B 101.101and B103.101-104) 44.3 t (furnace B 102.301)	200 mg/m^3	100 – 300 mg/m^3					
	CO	0.042 t (furnaces B 101.101and B103.101-104) 0.785 t (furnace B 102.301)	100 mg/m^3	50 – 100 mg/m^3					

[67] EL (emission limits) refers to (or are valid for) combustion of gases coming from refineries, a limit of 37mg/m^3 has been set in the permit for natural gas combustion.

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Catalytic Hydrocracking									
Reforming Furnaces H501-4/H505 HRR Furnaces H601/H602 (Note 2)	Particulates	2 mg/m^3 0.7 mg/m^3	5 mg/m^3	10 – 40 mg/m^3	Yes	Yes	Continuous Emissions Monitoring System	Monthly mean of half-hour measured value	101.325kPa 0°C 3% O_2
	SO_2	29 mg/m^3 37 mg/m^3	100 mg/m^3	10 – 350 mg/m^3	Yes	Yes			
	NO_2	151 mg/m^3 43 mg/m^3	200 mg/m^3	100 – 300 mg/m^3	Yes	Yes			
	CO	<1 mg/m^3 22 mg/m^3	100 mg/m^3	50 – 100 mg/m^3	Yes	Yes			
	HCl[68]	N/A	30 mg/m^3	No BAT-AEL	N/A	N/A			
Fluid Catalytic Cracking									
Air heating furnace and regenerator (Notes 1,2)	Particulates	36 mg/m^3 (31.9t)	50 mg/m^3	10-40 mg/m^3	Yes	Yes	Continuous Emissions Monitoring System	Monthly mean of half-hour measured value	101.325kPa 0°C 3% O_2
	SO_2	102 mg/m^3 (78.6t)	1700 mg/m^3	10-350 mg/m^3	Yes	Yes			
	NO_2	68 mg/m^3 (36.7t)	700 mg/m^3	100-300 mg/m^3	Yes	Yes			

68 Inorganic gas compounds of chlorine expressed as hydrogen chloride.

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Sulphur Recovery and Regeneration (Note 3)									
Sulphur Recovery Unit 1 (VJ 100) (Notes 1,2)	H_2S	2.08 mg/m^3 (0.465t)	10mg/m^3	20-150mg/m^3	Yes	Yes	Continuous Emissions Monitoring System (Note 3)	Monthly mean of half-hour measured value	101.325kPa 0°C 3% O_2
	SO_2	3723 mg/m^3 0.6% (603t)	1% *	99.5-99.9% reduction efficiency 400-2000 mg/m^3	Yes	No			
	NO_2	136 mg/m^3 (12.8t)	500 mg/m^3 (flow >10kg/h)	40-150 mg/m^3	Yes	Yes			
Sulphur Recovery Unit 2 (VJ 200) (Notes 1,2)	H_2S	2.72 mg/m^3 (0.402t)	10mg/m^3	20-150mg/m^3	Yes	Yes			
	SO_2	3718 mg/m^3 0.7% (466t)	1% *	99.5-99.9% reduction efficiency 400-2000 mg/m^3	Yes	No			
	NO_2	118 mg/m^3 (10.7t)	500 mg/m^3 (flow >10kg/h)	40-150 mg/m^3	Yes	Yes			
Sulphur Regeneration Unit (VJ 600) (Notes 1,2)	Particulates	17 mg/m^3 (0.584t)	150mg/m^3 (flow >0.5kg/h) 50 mg/m^3 (flow <0.5 kg/h)	10-40 mg/m^3	Yes	Yes			
	SO_2	707 mg/m^3 1.37 kg/te (12.2t)	2.2 kg / te Sulphuric Acid	400-2000 mg/m^3	Yes	Yes			

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	NO_2	32 mg/m^3 (1,206t)	500 mg/m^3 (flow >10kg/h)	40-150 mg/m^3	Yes	Yes			
Power Plant – combined total capacity									
K1 / K2 / K3 – fired on refinery or natural gas	Particulates	No Data	5 mg/m^3	5-20 mg/m^3	N/A	N/A	Periodic every 3 years	Not specified	Not specified
	SO_2		35 mg/m^3	5-20 mg/m^3					
	NO_2		200 mg/m^3	20-150 mg/m^3					
	CO		100 mg/m^3	No BAT-AEL					
	Ammonia (NH_3)		30 mg/m^3	2-5 mg/m^3					
K1 / K2 / K3 / K7 / K8 – Fired on heavy fuel oil at 1% sulphur (limited usage dictated by permit conditions)	Particulates	No Data	50 mg/m^3	5-20 mg/m^3	N/A	N/A			
	SO_2		1700 mg/m^3	50-850 mg/m^3 [x]					
	NO_2		450 mg/m^3	55-300 mg/m^3					
	CO		175 mg/m^3	No BAT-AEL					
	Ammonia (NH_3)		1 mg.m^3 (flow >5g/h) 5 mg.m^3 (flow >25 g/h) 30 mg.m^3 (flow >0.3 kg/h)	2-5 mg/m^3					
K11 – 14 – fired on natural	Particulates	No data	5 mg/m^3	5-20 mg/m^3	N/A	N/A			
	SO_2		35 mg/m^3	5-20 mg/m^3					

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
gas	NO_2		200 mg/m^3	20-150 mg/m^3					
	CO		100 mg/m^3	No BAT-AEL					

Notes:

1. Where mass emissions data are provided these are annual values provided by the operator. In these cases, a comparison cannot be made with permit ELVs or BAT-AELs.

2. Installation performance for concentration-based measurements data has been drawn from 5 web-published monthly reports (April, May, June, July and September 2008) based on continuous monitoring data. This data does not cover all emission points.

3) The apparent inconsistency between the concentration data and the total emissions data is because mass data is based on full year where the concentration is based on only 5 months (a full year's data were not made available for this assessment).

Emissions to water

COV Block 11 cooling water discharge into [Small] River Danube	Flow limit	82 l/sec	300 l/sec	0.09-0.53 m^3/t	Yes	N/A	As per Environmental District Office Decision Ou Ba II. Continuous Emission Monitoring System	Not specified	Not specified
	BOD	3.4 mg/l	10 mg O_2/l	2-20 mg/l	Yes	Yes			
	COD_{cr}	18.8 mg/l	25 mg O_2/l	30-125 mg/l	Yes	Yes			
	Suspended Solids	11.35 mg/l	30 mg/l	2-50 mg/l	Yes	Yes			
	Total hydrocarbon	0.26 mg/l	1.5 mg/l	0.05-1.5 mg/l	Yes	Yes			
	Phenol	0.025 mg/l	0.1 mg/l	No BAT-AEL	Yes	N/A			
	pH	7.52	6.5-8.5	No BAT-AEL	Yes	N/A			
COV Blocks	Flow limit	2359 l/sec	3200 l/sec	0.09-0.53 m^3/t	Yes	N/A			

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
17-18 cooling water discharge into [Small] River Danube	BOD	2.2 mg/l	10 mg O_2/l	2-20 mg/l	Yes	Yes			
	COD_{cr}	12.3 mg/l	25 mg O_2/l	30-125 mg/l	Yes	Yes			
	Suspended Solids	8.3 mg/l	30 mg/l	2-50 mg/l	Yes	Yes			
	Total hydrocarbon	0.12 mg/l	0.7 mg/l	0.05-1.5 mg/l	Yes	Yes			
	Phenol	0.028 mg/l	0.1 mg/l	No BAT-AEL	Yes	N/A			
	pH	7.63	6.5-8.5	No BAT-AEL	Yes	N/A			
Mechanical, Chemical and Biological COV – chemical wastewater discharge into River Danube	Flow limit	306 l/sec	500 l/sec	0.09-0.53 m^3/t	Yes	Yes			
	BOD	5.2 mg/l	20 mg O_2/l	2-20 mg/l	Yes	Yes			
	COD_{cr}	40.5 mg/l	80 mg O_2/l	30-125 mg/l	Yes	Yes			
	Suspended Solids	10.9 mg/l	20 mg/l	2-50 mg/l	Yes	Yes			
	Total hydrocarbon	0.14 mg/l	2 mg/l	0.05-1.5 mg/l	Yes	Yes			
	Phenol	0.026 mg/l	0.1 mg/l	No BAT-AEL	Yes	N/A			
	pH	8.3	6.5-9	No BAT-AEL	Yes	N/A			

4.7.12 Case study 11 – Spain

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 03/ES/10. The information in this table is based on the detailed assessment for this installation in Appendix F11. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The installation is a mineral oil and gas refinery with a capacity of 10,000,000 tonnes per year. It consists of the following units: ▪ Atmospheric distillation with propane and butane recuperation ▪ Vacuum distillation ▪ Visbreaker ▪ Naphtha desulphurisation ▪ Naphtha reforming with continuous regeneration ▪ Kerosene, heavy naphtha and kerosene desulphurisation ▪ Vacuum gasoil desulphurisation ▪ Hydrocracking units for light and heavy vacuum gasoil ▪ Isomerisation ▪ Merox unit ▪ Butane/isobutene separation ▪ Hydrogen production through steam reforming ▪ ETBE and MTBE production units ▪ Two cogeneration plants with a RTI of 152 and 30 MW_{th} respectively ▪ 4 back-up boilers, each with an RTI of 66 MW_{th} ▪ Sulphur recovery unit (SRU) ▪ Wastewater treatment plant (physico-chemical step followed by biological treatment) and sludge treatment – part of the oily wastewater streams are pretreated before being send to the WWTP ▪ Storage
Type of permit / issue date	The permit was issued on 4 July 2006. The reason for the permit application and the new permit was the implementation of the IPPC Directive in the Region.
Basis of BAT determination	The use of BAT is prescribed in the national and regional legislation (GBR) but it is not clear how BAT has been determined. There is national guidance on the implementation of BAT in the refinery sector, that differs from the BREF document on several issues. Besides this national guidance, there also seems to be guidance on the regional level (Regions are the competent authority for environmental issues in Spain) which, according to the competent authority, may be different from the national guidance and may differ from Region to Region. In this case there was no regional guidance for the BAT in the refinery sector.

Permit application	
Requirements of Article 6	The application was written based on a "IPPC template/guidance for industrial and energetic activities" provided by the regional government. This template/guidance seems to be in line with the requirements of Article 6 of the IPPC Directive, except for the consideration of the main alternatives. Both the competent authority and the operator state that a consideration of the main alternatives, as required by Article 6 (see below), is not required/applicable for existing installations. The refinery under assessment has been operating at the same location for over 30 years. The competent authority states that no measures were issued in the permit to prevent pollution risk at the time of site closure because it is compulsory for the operators to present a closure project if this should happen. The competent authority will check all the procedures and will set some general conditions and recommendations to avoid or limit the pollution in these cases.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** All issues raised in Article 3 of the Directive are addressed in the permit, some of these only in very general terms, however.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	The permit sets emission limit values to air for the refinery (bubble) and for individual units. The refinery bubble includes the combustion sources as well as the process emissions (sulphur recovery units, hydrocracker, etc.). The permit sets emission limit values for discharges to water. The discharges to water do not only include the wastewater from the refinery and the petrochemical plant but also the wastewater of a neighbouring petrochemical plant, responsible for some 37.6% of the total wastewater discharges.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** Specific reference is made to BAT when setting ELVs for emissions to air. According to the Competent Authority, the BAT concept has been implemented in the 'National Plan for Reduction of Emissions from Existing Large Combustion Plants', which seems to have been the basis for the setting of ELVs to air, which take the form of annual caps and concentration-based ELVs on the main stacks. No reference is made to BAT when setting the ELVs to water. The ELVs set are more stringent than the GBR for discharges to water and are a result of a voluntary agreement between the Competent Authority for Water and the industry association in the region, implying that all industry discharging to the same watercourse off-shore outfall watercourse is imposed the same ELVs. According to the Competent Authority, potential impact on the watercourse have been taken into account when negotiating this voluntary agreement. Both the competent authority and the operator state that the fact that the discharge point is located far away in the sea and with a significant dilution (over 1/1000) has been taken into account when setting the ELVs. The operator also states that ELVs for discharges to water have been more stringent than in the previous permits (e.g. 80% more stringent ELV for phenols) and that more pollutants have been considered in the new permit. **Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?** An analysis of the potential impact of the operation of the refinery on the local environment has been incorporated in the permit application and the Competent Authority has assessed the carrying capacity as well as the vulnerability of the receiving environment. According to the operator, other refineries in Spain belonging to the same group have different ELVs to water, depending on the watercourse they discharge into. This is additional evidence to the fact that local environmental conditions seem to be accounted for. According to the operator, technical characteristics (mainly age was referred to during the interview) are taken into account when determining permit conditions.

	Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator's economic circumstances)? No
Use of relevant BREF documents in setting permit conditions?	The use of BAT is prescribed in the national and regional legislation (GBR) but it is not clear how BAT has been determined. There is national guidance on the implementation of BAT in the refinery sector, that differs from the BREF document on several issues. Besides this national guidance, there also seems to be guidance on the regional level (Regions are the competent authority for environmental issues in Spain) which, according to the competent authority, may be different from the national guidance and may differ from Region to Region. In this case study there was no regional guidance for the BAT in the refinery sector.
Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** For the monitoring of emissions to air, measurement methodology and frequency and evaluation process are clearly described in the permit. There is a prescription to have a system of self monitoring for emissions to water. **Are the monitoring requirements sufficiently detailed?** Monitoring requirements for emissions to air are sufficiently detailed. GBRs (Regional and National legislation on discharges to water) apply to the monitoring requirements to water. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** Monitoring requirements for emissions to air are set according to the transposition of the Large Combustion Plants Directive in the National Legislation. **Does the permit include information on duration in relation to monitoring requirements?** Yes.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	There are no permit conditions that relate to conditions other than normal operating conditions, despite regional IPPC legislation establishing that "the IPPC permit shall contain measures relating to conditions other than normal operating conditions". According to the operator, the permit covers all operating conditions except emergency situations.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** No
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** There are no European or national EQSs that required stricter conditions than those achievable by the use of BAT.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	In the absence substantial changes, the permit is reconsidered every 8 years.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** The permit application has been subject to public participation during the permitting process. The permit is available on the internet. **Are monitoring records made available to the public?** Monitoring data are only available upon request.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	Emissions to air from the two main stacks are monitored continuously. Emissions to water are determined by the analysis of flow proportional samples, some pollutants are analysed on a daily and others on a weekly basis.
Operator's compliance with monitoring conditions	The emission monitoring system fully complies with the permit conditions.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	Since the permit was granted, the emissions of SO_2, NO_x and PM of the plant have decreased by respectively 44, 10 and 14% for the first major stack and 10, 29 and 26% for the second major stack.
Current emissions of key pollutants	This information is provided within the table below.
Assessment of Installation performance against BAT	According to the available monitoring data that have been provided by the Competent Authorities and cover the period from January 2008 until the end of October 2008, the installation meets the permit conditions for all pollutants to air and water. The concentration bubble for NO_x and PM to air also is within the ranges given by the BREF benchmark. The cogeneration plants do not meet the BAT-AEL set for NO_x for this type of unit in the refineries BREF. Emissions to water also do not meet the BAT-AEL from the refineries BREF (COD, BOD, suspended solids and total hydrocarbons).
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	The permit contains the general rule that 'In case of partial or total cessation of activities, the operator has to take all necessary measures to avoid any risk of contamination and to return the site into a satisfactory state in such a way that the environmental impact will be as low as possible'.
Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** • On-line access to the continuous monitoring data to air • Inspection by an accredited company every 2 years, first inspection 6 months after granting of the permit. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** So far, the CA has only had to write a formal enforcement letter in order to solve some minor non-conformities. **Procedures and/or systems used by the operator to ensure compliance with permit conditions** • ISO14000 system • Sufficient buffer capacity for wastewater **Procedures used or action taken by the operator in the event of non-compliance** The operator tries to solve the non-conformity as soon as possible in line with the procedures of the ISO14000 system.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** Inspection takes place once every 2 years.

Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Monitoring data are only available upon request.
Key observations from this case study assessment	
There has been no consideration of the main alternatives in the permit application as this is, according to national legislation, only required for new installations. The measures to be taken in case of site closure are also not incorporated in the permit, as this issue is covered by the national legislation and a plan has to be submitted by the operator in case of site closure. The permit conditions relating to emissions to air and water have not been based on the BREF document. The National Emission Reduction Plan under the Large Combustion Plant Directive, has been used for setting ELVs to air in the form of caps and annual average concentration ELVs. For example, the NO_x, SO_2 and PM_{10} permit ELVs (450, 300, 50 mg/Nm^3 respectively) for the cogeneration plants, catalytic reformer and thermal desorber all appear to be in line with the LCP Directive ELVs. The discharge to sea and the significant dilution resulting from this practice has been taken into consideration when setting ELVs to water. Emissions monitoring data for 2007 suggests that emissions from the installation are in line with permit conditions (ELVs). For air emissions, the majority of monitoring data indicate that emissions were within the BAT-AEL ranges with the exception of NOx emissions from the cogeneration plants. The measured emissions for the refinery combustion sources 'bubble' are within the benchmark range set out in the refinery BREF. For water emissions, whilst reported emissions were below the permit ELVs, for those where a BAT-AEL is specified in the refinery BREF (COD, BOD, suspended solids and total hydrocarbons) reported emissions were all above the BAT-AEL ranges. The detailed information is included in Appendix F11 with a summary of some relevant information in the table below.	

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
Refinery (bubble) – combustion sources only	PM10	25 mg/Nm³	150 mg/Nm³	N/A	Yes	N/A Within benchmark range	No data	No data	No data
	CO	33 ppm	1500 ppm		Yes		No data	No data	No data
	NOx	114 ppm = 234 mg/Nm³	300 ppm = 616 mg/Nm³	N/A	Yes	N/A Within benchmark range	No data	No data	No data
	H_2S	<0.4 mg/Nm³	10 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
Cogeneration plant I	CO	3 mg/Nm³	100 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
	NOx (as NO2)	225 mg/Nm³	450 mg/Nm³	20 – 75	Yes	No	No data	No data	No data
	SO2	28 mg/Nm³	300 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
	TOC	2.7 mg/Nm³	20 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
Cogeneration plant II	CO	1 mg/Nm³	100 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
	NOx (as NO2)	245 mg/Nm³	450 mg/Nm³	20 – 75	Yes	No	No data	No data	No data

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
	SO2	< dl	300 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
	TOC	0.9 mg/Nm³	20 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
Catalytic reforming plant regenerator (CCR)	HCl	< 0.82 g/h	300 g/h	N/A	Yes	N/A	No data	No data	No data
	PM10	8 mg/Nm³	50 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
Thermal desorber	VOC	0.1 mg/Nm³	3 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
Thermal desorber furnace	CO	1 mg/Nm³	100 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
	NOx (as NO2)	132 mg/Nm³	450 mg/Nm³	20 – 150 (gaseous fuel) 55 – 300 (liquid fuel)	Yes	Yes	No data	No data	No data
	SO2	< dl	300 mg/Nm³	5 – 20 (gaseous fuel) 50 – 850 (liquid fuel)	Yes	Yes	No data	No data	No data
	TOC	13.1 mg/Nm³	20 mg/Nm³	N/A	Yes	N/A	No data	No data	No data
Notes: * Benchmarks are not the same as BAT-AELs, as described elsewhere within this report.									

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to water									
Discharge point	COD	226 mg/l	700 mg/l	30 – 125 mg/l	Yes	No	No data	No data	No data
	BOD	76 mg/l	300 mg/l	2 – 20 mg/l	Yes	No	No data	No data	No data
	Suspended solids	58 mg/l	250 mg/l	2 – 50 mg/l	Yes	No	No data	No data	No data
	Total phosphorus	1.9 mg/l	30 mg/l	N/A	Yes	N/A	No data	No data	No data
	Tensio active substances	0.7 mg/l	6 mg/l	N/A	Yes	N/A	No data	No data	No data
	Cyanates	0.04 mg/l	1 mg/l	N/A	Yes	N/A	No data	No data	No data
	Phenols	< 0.2 mg/l	2 mg/l	N/A	Yes	N/A	No data	No data	No data
	As	< 0.025 mg/l	1 mg/l	N/A	Yes	N/A	No data	No data	No data
	Cu	< 0.025 mg/l	33 mg/l	N/A	Yes	N/A	No data	No data	No data
	Cr	< 0.025 mg/l	13 mg/l	N/A	Yes	N/A	No data	No data	No data
	Pb	< 0.025 mg/l	11 mg/l	N/A	Yes	N/A	No data	No data	No data

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
	Zn	0.81 mg/l	10 mg/l	N/A	Yes	N/A	No data	No data	No data
	Total hydro-carbons	6.5 mg/l	15 mg/l	0.05 – 1.5 mg/l	Yes	No	No data	No data	No data
	Phosphates	0.9 mg/l	90 mg/l	N/A	Yes	N/A	No data	No data	No data
Emissions to land									
Not applicable.									

4.7.13 Case study 12 – United Kingdom

Assessment of permit determination procedures and permit conditions

Introduction	
The unique reference number for this installation is 03/11/UK. The information in this table is based on the detailed assessment for this installation in Appendix F12. Further information and elaboration on certain points is included in the detailed assessment.	
Overview description of type of installation / application	The activities of the Installation are covered under activity “1.2 Mineral oil and gas refineries” as specified in Annex 1 of Directive 2008/1/EC. The refinery has been operational since the 1960s and comprises the following core process areas as described within the introductory note of the IPPC permit: 1) Large Combustion Plant: A crude oil heater (running on refinery oil) with an 85MW rated thermal input; 2) Oil refining process with a nominal annual capacity of 5.5 million tonnes of crude oil to produce a range of fuels, which includes the following process plants: ▪ Crude oil import and storage; ▪ Crude oil unit (wash, preheating, heating and distillation); ▪ LPG unit (separating LPG from the fuel gas from crude oil unit); ▪ Kerosene sweetening unit (Merox) for conversion of Mercaptans to Dimethylsulphide; ▪ Hydrosulphurisation/Dewaxing Unit (HDS) for removal of sulphur and conversion of paraffin waxes to lower boiling point hydrocarbons; ▪ Sour water stripping used in the HDS to wash ammonium sulphide from the heat exchangers; ▪ SulFerox (sulphur recovery unit) to convert H_2S into elemental sulphur; ▪ Product blending of two main fuels (kerosene and diesel) with additional 5% biodiesel blending activity; this takes place at the ‘Road & Rail Terminal’ ▪ Steam raising boilers (No’s 4, 5 & 7) with thermal ratings of 18.2, 14.6 and 12.1 MW) ▪ Road & Rail Terminal, which is 1.5km from the works where loading of kerosene, gas oil and low-sulphur diesel into dispatch tanks is undertaken prior to road or rail freight distribution).
Type of permit / issue date	The permit was issued as part of transitional arrangements for an existing installation from a previous UK regulatory regime (Integrated Pollution Control). The application was submitted by the Operator in August 2006 and the permit was formally signed and issued on 31st October 2007.
Basis of BAT determination	BAT for the installation was assessed using the UK Sector Guidance Note (SGN) S1.02 (Draft_Version 4). This technical guidance document is a Member State level distillation of the BAT-Reference Document (BREF) with many of the BAT-AELs transposed into sector-benchmark values. BAT has been specifically assessed (and summarised in the Decision Document) for: ▪ SO_2 (sulphur recovery unit); ▪ NO_x (low-NO_x burners); ▪ Flaring; ▪ VOC measurement; ▪ Leak Detection and Repair (LDAR) and fugitive emissions control programme; ▪ Refinery fuel use and specifications; ▪ Combustion and abatement equipment; ▪ Bunding and spillage containment. The use of environmental management systems together with other information provided by the Operator has also been taken into account in the determination of BAT.

Permit application	
Requirements of Article 6	The application fully met all the requirements of Article 6. In certain areas, the Competent Authority requested additional supporting material (including further analysis and assessment reports) in order to ensure that a robust analysis of BAT for the site could be made.
Permit conditions and permit determination process	
Assessment of the general principles governing the basic obligations of the operator (Article 3(a)-(f))	**Overall statement** The IPPC permit has been developed by the Competent Authority in such a manner that conditions are placed within the permit to ensure that the installation is operated in accordance with the requirements of Article 3 (a-f). (See below). Where conditions have not been placed in the permit or would not represent the requirement to implement BAT, Improvement Conditions have been set on a defined schedule to require the Operator to remedy the situation or implement such measures that would be necessary to meet the requirements of Article 3. The majority of the technical improvements were scheduled for completion in 2008, with completion of NOx abatement measures by the end of 2010 and improvements to the sulphur recovery systems required by 2011. Tier 3 of the LDAR programme is the longest running condition, which is indicated by the permit to be completed by 31.12.2012. The permit details the operating techniques to which the Operator must adhere in order to ensure that the impact of activities on the environment is minimised as far as practicable.
Inclusion of ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBR (Article 9(8))	Conditions are placed in the permit that relate to the requirement to comply with the schedule of ELVs contained within the permit itself. These conditions require no unauthorised discharge to any point not specified in the permit. The condition also make reference to the fact that the limits (both concentration and mass limits) listed in the permit must not be exceeded. **Air:** ELVs have been set for the following emission points: ▪ NO_x and SO_2 limits on the HDS heater (heater unit integrated with the sulphur recovery system); ▪ Particulates limit on the Crude Oil Furnace (no NO_x or SO_2 limit set – see below) ▪ NO_x, SO_2 and particulates limits on the steam boilers No. 4, 5 and 7 No limits for NO_x and SO_2 emissions from the crude oil furnace stack have been set in the permit. Despite the furnace falling under the Large Combustion Plant Directive, the competent authority has chosen not to set NO_x or SO_2 limits based on the following justification. ▪ With regard to NO_x emissions, the justification made by the competent authority for not setting an ELV on this emission point has been that the National Emission Reduction Plan (NERP) cap NO_x emissions from the site (for LCP) at 308 tonnes per annum. This limit has been judged by the competent authority to be more restrictive than the benchmark value of 450mg/m^3. ▪ With regard to emissions of SO_2, the justification made by the competent authority for not setting an ELV on this emission point has been that the emissions are controlled by the National Emission Reduction Plan (NERP) cap and the overall mass sulphur limit of 1400 tonnes per annum applies. The permit does not set any limits for fugitive VOC emissions from storage tanks or emissions from the flare stack. The permit requires the operator to implement a leak detection and repair (LDAR) programme, including a calculated annual VOC emission total from fugitive and vent sources. The operator is also obliged to calculate and report annual emissions from the flare stack. **Water:** ELVs have been set in the permit for all discharges made from the site's effluent treatment facility. **Land:** No ELVs have been set to land as direct discharges are not permitted. **Protection of soil and groundwater:** No ELVs have been set for soil and groundwater as direct discharges are not permitted.

	Waste: No specific limits have been set on waste within the permit, although a condition exists requiring the operator to take appropriate measures to ensure that waste production is avoided or reduced etc. However, the interpretation of 'appropriate measures' is set out in the Decision Document rather than the permit itself. **Transboundary considerations:** The permit sets no specific ELVs to minimise the impact of transboundary pollution. The impact of the installation was judged not to have any significant effect on neighbouring Member States. The NERP limits under the LCPD have been set taking into account the potential for transboundary pollution. **Further equivalent technical parameters/measures have been set for:** The permit contains technical parameters that the installation is required to comply with. These have been set for: ▪ Feedstock to Crude Oil Unit shall be as described in the application and supplemental information provided in October 2007; ▪ Refinery fuel oil shall contain less than 1% sulphur (monthly average); and ▪ Refinery fuel gas shall contain less than 200ppm of sulphur (daily average). ELVs have been set for key emissions to air and water with the exception of NO_x and SO_2 from the crude oil furnace stack, which falls under the Large Combustion Plant Directive.
Inclusion of permit conditions based on BAT (Article 9(4))	**Are the permit conditions relating to ELVs and the equivalent technical measures based on BAT? Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?** Most of the conditions in the permit relating to aspects such as energy efficiency, waste prevention, recovery and disposal, pollution prevention and raw materials are based on BAT as defined by the UK Sector Guidance Note IPPC S1.02 'Guidance for the Gasification, Liquefaction and Refining Sector'. The majority of the ELVs (where they are set) have not been set based on BAT-AELs from the BREFs and are set in some cases, considerably higher. **Crude oil furnace** The crude oil furnace has not been assessed against the LCP Directive. The competent authority recognised that some of the limits in the permit were not set in line with BAT-AELs and in response to this, a series of Improvement Conditions within the permit have been set to reduce NO_x emissions through the use of BAT. The written plan on how the operator intended to meet this improvement condition was submitted in early 2008 with installation of NO_x abatement measures required by 2010. Based on the assessment of maximum sulphur emission concentrations, the competent authority is satisfied that the EU Air Quality Standard for sulphur will not be breached (even with a 25% increase in maximum concentrations) and has therefore chosen not to set ELVs to control SO_2 emissions from the large combustion plant. The conclusion is therefore that the competent authority has not based their assessment of suitable ELVs on BAT-AELs as presented in the BREF document on mineral oil and gas refineries. **Other emission points** Where necessary, the Competent Authority has used Improvement Conditions (set in order to raise the current performance standard) in the permit to require that the Operator makes improvements as necessary to achieve compliance with BAT and minimum air and environmental quality standards. These Improvement Conditions are directed at reducing the priority impacts of the installation such as H2S and sulphur recovery, NOx and control of fugitive VOC emissions. For NO_x emissions from point A5 (steam boilers), the competent authority recognises that the permit ELVs of 800mg/m^3 are not in accordance with BAT and therefore have placed an Improvement Condition in the permit that requires the Operator to reduce NO_x emissions to below 400 mg/m^3 by the end of 2010. This limit for liquid fuelled boilers, taken from the UK Sector Guidance Note on combustion (IPPC S1.01), is still outside the BAT-AEL range of 55-300 mg/m^3 indicated in the BREF document on refineries. The Operator's BAT justification for deviation from BAT-AELs for SO_2 emissions from the HDS vent have been assessed by the Competent Authority and judged not to be suitable and therefore additional permit conditions have been set that require the Operator to upgrade the plant in order to meet the BAT standard for sulphur recovery. BAT, as presented in the BREF on mineral oil and gas refineries, for the SRU is a tail gas treatment unit that achieves a minimum recovery efficiency of 99.5%. However the competent authority has judged that, due to the relatively small size of the installation, 96% recovery with 100% availability is considered by the authority to represent the BAT for this site. This condition is

	therefore not commensurate with the BAT contained within the BREF document.

	Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?
	The permit conditions have been drafted based on what the competent authority described as ‘a very thorough and careful consideration of the Sector Guidance Note, BREF and IPPC application’. There is clear evidence throughout the competent authority ‘Decision Document’ that any permit condition ELV (or lack of it) has been based on:
	▪ a site-specific assessment , where deviations from setting permit ELVs in accordance with BAT-AELs have been assessed to ensure that they will not cause a breach of EU or national air quality standards or environmental quality standards;
	▪ the emissions from a particular point source (e.g. crude oil furnace) are controlled via a ‘cap’ under the NERP; or,
	▪ improvement conditions within the permit have been set to seek to ensure that the operator implements measures that seek to reduce emission concentrations of the following pollutants to a level that is commensurate with BAT-AELs;
	    ▪ SO_2 – upgrading of the SRU to increase sulphur recovery (plan submitted 2008, operational 2011);
	    ▪ NO_x – measures to reduce emissions from the steam boilers and the crude oil furnace (plan submitted by 2008, operational by 2010) ;
	    ▪ VOCs – LDAR programme (inc. repair) and monitoring plan (plan submitted by 2008, Tier 3 completed by 2012).
	Technical characteristics
	Permit conditions have been developed taking into account the technical characteristics of the installation. The installation is (in comparison with other UK installations) quite a small and simple refinery. The limited scope of activities within the installation boundary mean that, for certain emissions, the technical characteristics constrain the Operator’s ability to directly implement techniques or technologies that have been indicated in the Sector Guidance Note and the BREF as BAT.
	The use of ultra-low NO_x burners is one of the techniques considered to represent BAT in the BREF. However the technical characteristics (available space) of the boilers and furnace limit the use of this technology and therefore the Operator has made a justification for BAT being low-NO_x, which the competent authority has accepted on the basis that the upper range of the BAT-AEL of 400 mg/m^3 can be met.
	The use of 3-stage Claus reactors for sulphur recovery is considered to represent BAT. However the limited throughput gas volumes due to the small installation processing capacity mean that this configuration would not be optimally effective and therefore the Operator has made a justification for single-stage Claus reactor. The competent authority has accepted this justification as being BAT provided that the unit operates at a minimum efficiency of 96% with a view to working towards 99% or more.
	Local environmental conditions & geographic location
	An impact assessment has been completed by the operator for the most significant emissions from the installation and based on worst-case results the emissions will not lead to a breach of Air Quality Standards. This provides evidence that specific local environmental conditions and geographic location have been taken into account.
	Is there evidence of any trade-offs to balance different environmental impacts (such as emissions to different media)?
	None observed.
	Is there any evidence of factors influencing permit conditions not compatible with Directive (e.g. operator’s economic circumstances)?
	None observed.

Use of relevant BREF documents in setting permit conditions?	The competent authority did not directly use the BREF in determination of permit conditions but relied on the UK’s technical regulatory guidance (SGN S1.02) to provide this information. As indicated above, this is based heavily on the BREF.

Inclusion of release monitoring requirements in accordance with (Article 9(5)) that specify: - measurement method - frequency - evaluation procedure - an obligation to supply data	**Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?** The permit contains comprehensive monitoring requirements. These requirements specify the methods, frequencies and referencing periods (where applicable) and an obligation to supply this information to the CA. **Are the monitoring requirements sufficiently detailed?** The monitoring requirements are sufficiently detailed to enable the Operator to clearly understand what monitoring is required and how to undertake it. **Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?** The Competent Authority has developed a single monitoring standard for Operators of industrial installations to follow. This system, know as MCERTS, has been developed having regard to the detailed requirements of the BREF document although in some cases it describes the use of generic rather than sector-specific techniques. The permit requires the Operator to utilise technologies and techniques for monitoring that are compliant with the MCERTS scheme or appoint contractors that are compliant. Further details are presented in the table at the end of this case study. **Does the permit include information on duration in relation to monitoring requirements?** Yes, duration for each monitoring parameter is included in the permit.
Inclusion of measures relating to conditions other than normal operation? (Article 9(6))	No the permit does not contain such conditions.
Prescription of requirements in general binding rules (GBRs) (Article 9(8))	**Are there any GBRs implementing the IPPC Directive that govern control of the installation and if so, how do they interact with the permit?** No.
Reference to need to comply with EQSs (Article 10)	**Are there relevant Environmental Quality Standards that require stricter conditions than those achievable by the use of BAT and was this reflected in the permit or supporting documentation? If so, what measures have been placed in the permit to ensure compliance with EQSs?** There are no relevant EQSs that require stricter conditions than those achievable through the implementation of BAT. The Operator’s impact assessment has been completed on a worst-case basis having regard to the local environmental air quality objectives and environmental quality standards. The impact assessment report demonstrates that emission levels at worst case would not break any imposed Community or national EQS.
Inclusion of information on period of validity of permit and when it will be reconsidered / updated (Article 13)	The permit does not contain this information. The legislation implementing the Directive does not specify a minimum frequency for permit review. Instead the competent authority's policy is to review permits every 8 years, although in practice the competent authority has the power to request a review of BAT at any time and operational conditions are regularly reviewed following site inspections. Changes to the permit conditions may be made through standard or substantial variations. The review of this permit will be due no later than 2014.
Public Participation and access to relevant documentation in accordance with the requirements of (Article 15(a))	**Are the application/ decision document and permit available on a public register?** Yes, upon request or available on the public register at the competent authority offices. **Are monitoring records made available to the public?** Yes, upon request or available on the public register at the competent authority offices.

Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring	
Details of current monitoring undertaken by the operator	The operator has confirmed that all monitoring (with the exception of TOC on W1) is undertaken in accordance with the requirements of the permit conditions. The operator also indicated the technical limitations of the installation that prevented the widespread use of Continuous Emissions Monitoring (CEMs) equipment. In place of continuous monitoring (as is indicated as BAT for all emission points by the monitoring guidance MCERTS M2), the installation employs spot sampling through an external MCERTS-accredited company. The issue of CEMs was discussed with the competent authority and the rationale for not requesting this on the LCP and boiler units has been to accept the operator's case on technical limitations of implementing CEMs and the fact that modelled worst-case emissions scenarios confirm that the impact of the emissions upon the receptors was not likely to be significant. In order to satisfy themselves that the operator would be able to comply with permit conditions, the competent authority placed an improvement condition in the permit for the operator to submit a written procedure detailing the monitoring measures that would be used to ensure compliance with permit conditions – a response to this was submitted on 30/06/2008.
Operator's compliance with monitoring conditions	The operator has confirmed that monitoring is undertaken in accordance with the permit requirements in all aspects with the exception of the following: ▪ W1 emissions from site drainage. The permit requires a compositional flow proportional sample using CEMS equipment. The Operator has confirmed that this is not technically feasible as they have no CEMS equipment or ability to composite flow sample their effluent steam as it is routed to an adjoining plant (under internal agreements but not in ownership of the Operator) for treatment. The competent authority has confirmed that this is acceptable and is working to amend the permit conditions to reflect the technical difficulties.
Installation performance	
Emissions of key pollutants prior to implementation of the IPPC permit	As the operator submitted their application for an IPPC permit in 2006, the emissions benchmark data within this submission has been used as a reference for pre-permit installation performance for key emissions: **Key Air Emissions** ▪ A4 [Crude Oil Furnace] - NO_x – 524 mg/m^3 - SO_x – 403 mg/m^3 - Particulates – 44 mg/m^3 ▪ A2 [HDS heater] - NO_x – 347 mg/m^3 - SO_x – 4,497 mg/m^3 - Particulates – 0 mg/m^3 ▪ A5 [Boilers] - NO_x – 1,275 mg/m^3 - SO_x – 1,109 mg/m^3 - Particulates – 89 mg/m3 ▪ A6 [Sulpherox Vent] - NH_3 – 3,262 mg/m^3

	Key Water Emissions ▪ W1 [Crude decanters – combined LPG & HDS] weekly averages (with ranges) - Suspended solids – 38 mg/l (1 - 280 mg/l) - TOC – 188 mg/l (96 – 745 mg/l) - pH – 8.6 (7.4 – 10.5)
Current emissions of key pollutants	**This information is provided within the table below.** The installation permit was issued in October 2007 and as such a complete annual monitoring record since permit issue was not yet available from the operator. In response to this lack of data, questions were asked at the interview to illicit an objective assessment of emissions currently from the installation compared to pre-IPPC permit. **Air** The implementation of IPPC has (as yet) made no significant difference to air emissions although the Operator recognises that upgrades to the plant abatement equipment such as low-NO_x burners (operational by 2010) and SO_2 abatement (commissioned 2010, operational by 2011) will effectively reduce the installation's air emissions. The implementation of a LDAR programme and monitoring plan for fugitive VOC emissions will support the reduction of fugitive VOC emissions between 2008-2012. **Water** No significant changes to water discharges have been made since the issue of the permit.
Assessment of Installation performance against BAT	In light of the above, the Competent Authority provided an annual return from the year ending 2007. However, the permit only covers those emissions after October 31st 2007. Assessment of the available monitoring data on the emissions from the installation since permit issue demonstrates that with the exception of boilers 4 and 5, emissions from all authorised points are within permit limits. The assessment shows that with regard to emissions of NO_x and SO_2, the installation performance does not achieve the BAT-AELs in all cases. In response to this, the competent authority has set improvement conditions within the permit to abate the level of emissions to BAT-AELs through low-NO_x burners and H_2S Claus reactors for sulphur recovery.
Inclusion of measures foreseen to ensure that at cessation of activities, the site is returned to satisfactory state (Article 3(f))	A Site Closure Plan has been drafted by the operator and approved by the Competent Authority. Formal approval from the Competent Authority is pending. Conditions are placed in the permit to ensure that this plan is implemented prior to acceptance of permit surrender by the Operator.

Sanctions and ensuring compliance	
Measures taken by the Competent Authority to ensure compliance with permit conditions (Article 14)	**Procedures used by the Competent Authority for ensuring compliance:** The competent authority produces an annual Compliance Assessment Programme (CAP) for the installation. This CAP details the types and frequencies of audits, inspections and reviews that will be undertaken in the coming 12 months and the areas that will be priority investigations. **Have sanctions or other measures been applied in cases of non compliance with the permit conditions?** The operator has had more than one breach of ELV with regard to water emissions off-site. These breaches have been addressed by the competent authority in the form of site warnings and modifications (through a minor variation) to the Improvement Programme in the permit that require the operator to investigate the variance on Suspended Solids concentrations and pH. Whilst this action is being completed, the operator has received a higher maximum permit ELV (through a variation that was not issued/available at the time of assessment) for a short period of time until a solution is found and remediation can be made. A breach of the permit limit of 100 mg/m^3 for particulate matter from the boilers was noted upon examination of the monitoring documents submitted by the operator. Following consultation, the following response was given by the competent authority: *"The particulate limits were also 100 mg/m^3 before the IPPC permit was issued so the response taken is indicative of the likely response in the future too. In response to these breaches, the operator instigated a major inspection on No.4 boiler. That resulted in some replacement parts for that boiler and also some new parts for No.5 boiler. By December 2007, after this work was done, particulate sampling results on both boilers were back to approximately 20mg/m^3."* **Procedures and/or systems used by the operator to ensure compliance with permit conditions** The operator has internally-drafted IPPC-procedures that detail the actions that are required to ensure compliance with each permit condition. Operators are fully trained on environmental procedures to ensure awareness and the key Operating Instructions cross-reference the IPPC-procedure. **Procedures used or action taken by the operator in the event of non-compliance** The operator has drafted internal procedures for reporting breaches against permit conditions. The permit contains specific reporting forms for any breach of ELV or conditions.
Operator must afford the competent authority all necessary assistance to allow inspections to be carried out, to gather information and to take samples	**Does the competent authority conduct on-site inspections and how many have been undertaken in the past 12 months?** The competent authority reported that it conducts on-site inspections in accordance with the drafted annual Compliance Assessment Programme (CAP). The CAP sets out the level of investigation (previously termed major and minor audits) together with the areas that will form the annual assessment (waste minimisation, effluent discharges, etc.) Since permit issue in October 2007, the competent authority has conducted an Operator Monitoring Assessment, which is one of the most rigorous and significant of all on-site compliance audits. This reviews all site operations and procedures related to monitoring, including assessment of technical monitoring equipment, calibration and use of certified 3rd party monitoring organisations. Several informal visits have also taken place to guide and discuss issues related to the upgrade of the Sulphur Recovery Unit.
Provision of access to data and public participation (Article 15)	**Are the results of monitoring and compliance audits available to members of the public?** Results of monitoring are available upon request. The results of regulatory compliance assessments are not made available routinely to members of the public, nor published electronically; however they can be viewed within the working file at the local office.

Key observations from this case study assessment

- The competent authority has taken a structured approach in the UK to permitting installations falling within Category 1.2 of Annex 1 of the IPPC Directive. It was apparent that many discussions took place at a strategic level between Operators, Trade Organisations and Regulatory Authorities regarding the requirement to achieve consistency in permitting this sector. For this particular case study, this has resulted in a concise permit, which contains conditions that address each of the Directive's requirements and that is supported by a very clear and comprehensive decision document.
- Overall, a significant number of the techniques employed by the operator were not judged by the competent authority to be BAT. In this case, the competent authority has used a series of improvement conditions within the permit to require the operator to make proposals and to implement such measures to reduce emissions of SO_2, NO_x and VOC pollutants in line with the indicative BAT Benchmark values expressed in the Sector guidance Note IPPC S1.02.
- It is evident that, a number of permit ELVs have been set above the BAT-AELs as given in the BREF document on mineral oil and gas refineries. A justification for deviation has been made on the grounds that:
  - Improvement conditions have been placed within the permit that require the Operator to identify and implement techniques to reduce the level of emissions of certain pollutants, where it has been demonstrated that they are of significance, to benchmark levels as given in the UK's Sector Guidance Note. These benchmark levels are, in most cases, equivalent to the BREF BAT-AELs (see below).
  - For emissions of NO_x and SO_2 from the crude oil furnace stack, (no emission limits values have been set. This has been justified by the competent authority on the basis that an 'emissions cap' applies under the National Emissions Reduction Plan and the equivalent emission factors (based on mass emission) were considered by them to provide sufficient environmental protection, including compliance with community EQSs.
- The permit includes conditions that require the operator to implement measures to facilitate reductions of NO_x and SO_2 emissions however the proposed techniques are not in all cases wholly in line with BAT as presented in the BREF on mineral oil and gas refineries. The justification for the deviation made by the competent authority is that the technical characteristics of the plant (low throughput, simple refining process) together with a modelled assessment of worst-case environmental impacts demonstrates that the measures proposed are sufficient to ensure a high level of protection for the environment as a whole. For example;
  - Improvement conditions are in the permit that requires the operator to fit low-NO_x burners on the boiler and furnace units to ensure that emission levels are brought below the benchmark value of 400 mg/m^3, although this value remains above the 55-300 mg/m^3 range indicated in the BREF on mineral oil and gas refineries (5.10 pp.408).
  - SO_2 emissions will be minimised through the use of a sulphur recovery unit with tail gas treatment; however the efficiency stipulated by the competent authority in the permit is not in line with BAT (96% recovery as opposed to 99.5-99.9% as detailed in the BREF (5.23 pp.413).
- The performance of the installation complies with all permit emission limits with the exception of the No. 5 boiler with respect to particulate matter emissions. This has since been corrected through proactive maintenance and is now at a level within the BAT-AEL range of 5-50 mg/m^3.

Summary of installation performance, permit ELVs, BAT-AELs and monitoring methods

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding Refineries BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual) Method	Sampling/ measurement time	Reference Conditions
Emissions to air									
A2 HDS Heater	NO_x	387 mg/m^3	450 mg/m^3	55 – 300 mg/m^3	Yes	No	Monthly ISO10849	Hourly average (Actual)	Not given
A2 HDS Heater	SO_2	5149 mg/m^3	8000 mg/m^3	50 – 850 mg/m^3	Yes	No	Monthly ISO7935	Hourly average (Actual)	Not given
A4 Crude Oil Furnace Stack	NO_x	562 mg/m^3	No limit – NERP cap of 308 te/yr	55 – 300 mg/m^3	Yes	No	Monthly ISO10849	Hourly average (Actual)	Not given
A4 Crude Oil Furnace Stack	SO_2	378 mg/m^3	No limit - NERP cap of 1400 te/yr	50 – 850 mg/m^3	Yes	Yes	Monthly ISO7935	Hourly average (Actual)	Not given
A4 Crude Oil Furnace Stack	Particulates	10 mg/m^3	100 mg/m^3	5 – 20 mg/m^3	Yes	Yes	6-monthly BSEN13284-1	Hourly average (Actual)	Not given
A5 Steam boilers 4 & 5[3]	NO_x	592 / 682 mg/m^3	800 mg/m^3	55 – 300 mg/m^3	Yes	No	Monthly ISO10849	Hourly average (Actual)	NO_2 at 3% O_2
A5 Steam boilers 4 & 5[3]	SO_2	657 / 664 mg/m^3	800 mg/m^3	50 – 850 mg/m^3	Yes	Yes	Monthly ISO7935	Hourly average (Actual)	SO_2 at 3% O_2
A5 Steam boilers 4 & 5[3]	Particulates	129 / 110 mg/m^3	100 mg/m^3	5 – 20 mg/m^3	No	No	6-monthly BSEN13284-1	Hourly average (Actual)	N/A
Notes: BREF averaging period is 24 hours.									

Emission point reference	Pollutant	Installation performance (inc. units)	Permit Limit (ELV) (inc. units)	Corresponding Refineries BREF BAT-AEL (inc. units)	Compliant with permit?	Emissions within BAT-AEL range?	Monitoring (actual)		
							Method	Sampling/ measurement time	Reference Conditions
Emissions to water									
Notes: No monitoring results were made available.									

4.7.14 Conclusions from the installation-specific findings

Nine out of the 11 installations covered in this assessment received their permit over the period 2006 to 2008. Only the installations in CZ and in PL received their permit in 2003 and 2005 respectively. Permits for the installations in EL have been issued after 31/10/2007, which was the deadline for existing installations to be in line with the requirements of the IPPC Directive (and one of these permits was not formally issued at the time that the site visit and review took place).

Two of the permits examined (BE and DE) were issued as the result of an application for substantial changes from the operator. Use was made of this permit application to bring the existing permits in line with the requirements of the IPPC Directive. In two cases (FR and NL) the existing permits were reviewed based on an IPPC compliance check by the operator as requested by the competent authority, revealing that the existing permit and operations were not fully in line with the requirements of the IPPC Directive. In all other Member States (CZ, EL, PL, SK, ES and UK) a new permit has been issued for the installation as a result of the implementation of the IPPC Directive.

The approach taken to bring the permits in line with the IPPC Directive differs from Member State to Member State. By way of example:

- Some Member States (BE, FR, NL) have performed a BAT assessment and have updated permit conditions whenever existing permit conditions were not consistent with BAT.
- Other Member States (CZ, EL, PL, SK) have issued completely new permits for these installations according to a procedure which is in line with the legislation transposing the IPPC Directive in the particular Member State. In some Member States (e.g. BE, EL) a BAT assessment forms an integral part of a permit application.

Because in NL and FR use has been made of an IPPC compliance check to initiate a possible modification of the permit conditions, the operator has been relieved of the administrative burden of making a permit application. In BE, this would also have been the case had a request for a substantial change/modification not been filed by the operator. There are no indications that using this approach as compared to issuing a new permit has led to the setting of more (or less) stringent permit conditions.

The ELVs in the individual permits generally cover the main pollutants (SO_2, NO_x, PM and NMVOC emissions to air; BOD, COD, suspended solids and hydrocarbon emissions to water) and the most important sources (combustion sources (boilers, heaters and furnaces) as well as process emissions (catalytic cracker, VRU) to air). However, three of the permits do not specify ELVs for emissions of NMVOC to air.

Due to the fact that bringing the permits for existing installations in line with the IPPC Directive has started late (the majority of the permits being delivered over the period 2006-2008) and that certain modifications to installations can only be done during shutdown or turnaround (due to technical limitations), transition periods for implementing improvements – in some cases up to 4-8 years – have been granted on an individual permit level. As a result, some installations' emissions are not currently within the BAT-AEL ranges and/or benchmarks from the refineries BREF but this situation may improve as technical improvements are implemented.

By way of comparison with the sector-level evaluation, an analysis of the load bubbles for the case study refineries has been undertaken. Whilst there are uncertainties in the data used (as highlighted within the general sector evaluations), these data provide a basis for comparison of the case study installations with the wider sector conclusions.

The load bubbles for SO_2 and NO_x for the individual refineries assessed for 2004 and 2006 (2007 for UK) are illustrated in Figure 4.15 and Figure 4.16 and confirm the findings of the sector wide assessment. These figures show the mass of SO_2 and NO_x emissions in tonnes compared to the nameplate capacity of the refineries (in million tonnes of crude) (compare with figures in Appendix G):

- SO_2 load bubbles are the highest in EL, PL and ES;
- None of the installations fell within the SO_2 load bubble value described in the BREF in 2004[69];
- Only one installation fell within the SO_2 load bubble value described in the BREF in 2006/2007;
- Six of the eleven installations show an increase in their SO_2 load bubble over the period 2004-2006 while for three installations the SO_2 load bubble has decreased (data for the other two installations were not available for both years);
- Three out of the eleven installations fell within the NO_x load bubble value described in the BREF[70] in 2004 while only one still met the NO_x load bubble value in 2006/2007;
- Five of the eleven installations show an increase in the NO_x load bubble over the period 2004-2006 while for three installations the SO_2 load bubble has decreased;
- An improvement in the load bubbles to air could only be demonstrated for one of the two installations that were granted a permit in the period 2003-2005;
- It can be seen from both of the figures that complexity is not necessarily a marker for higher emissions.

The uncertainties and differences in data collection methods mentioned in the general sector evaluation also apply here.

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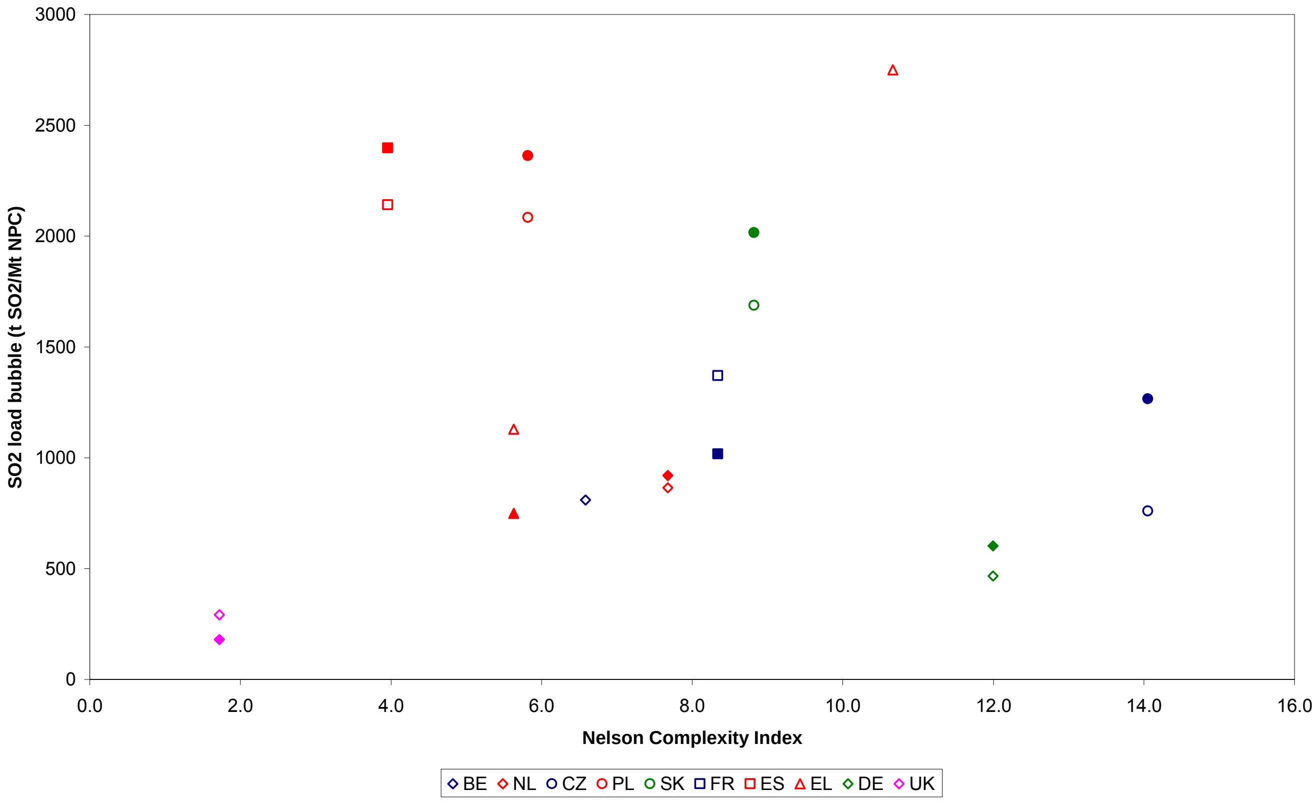
69 50 to 210 or 50 to 230 t SO_2/Mt throughput (see Table 4.3). Nameplate capacity is used as a surrogate for throughput in this part of the analysis.

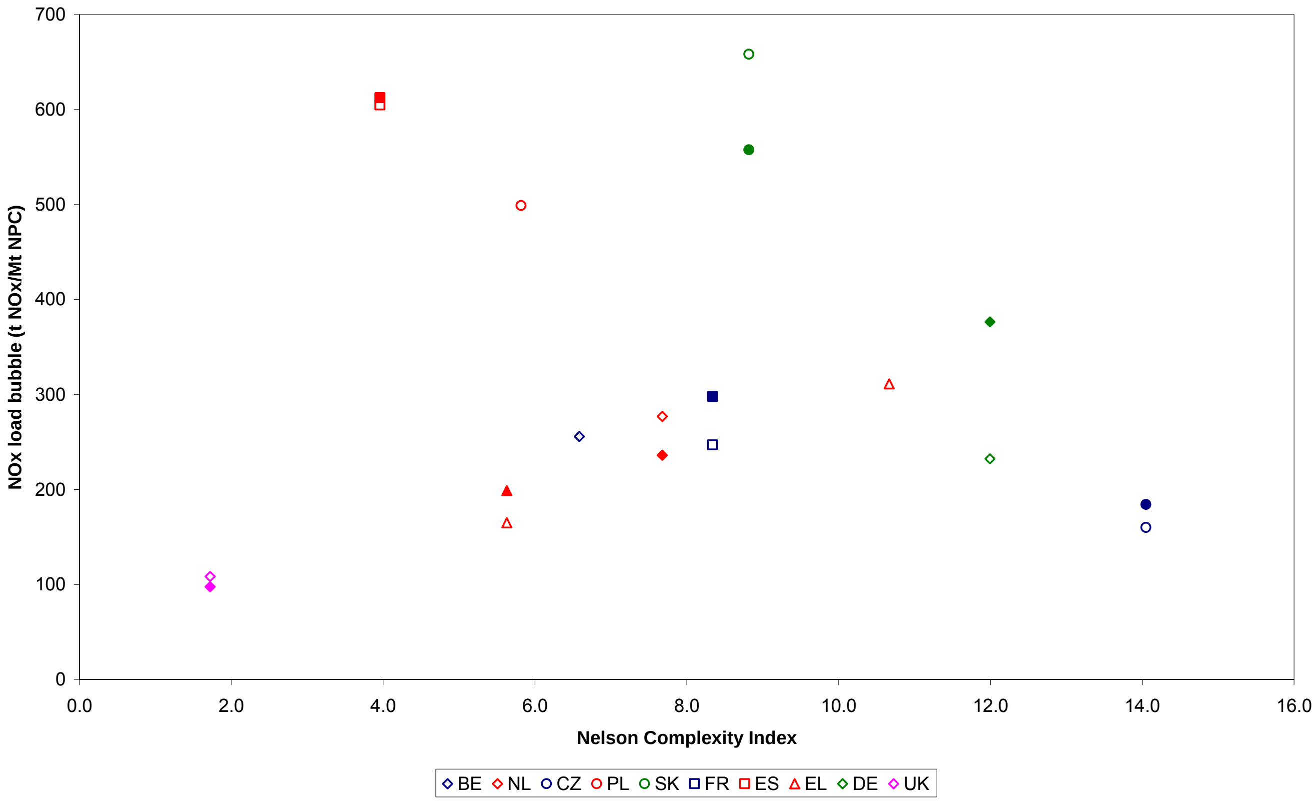
70 20 to 150 or 80 to 170 t NO_x/Mt throughput (see Table 4.4).

Figure 4.15 SO_2 load bubble (based on NPC) as a function of Nelson complexity index for the case study installations



Note: Non-shaded symbols in the figure are based on 2004 emissions data; shaded symbols are based on 2006 emissions data (2007 for the UK).

Figure 4.16 NO_x load bubble (based on NPC) as a function of Nelson complexity index for the case study installations



Note: Non-shaded symbols in the figure are based on 2004 emissions data; shaded symbols are based on 2006 emissions data (2007 for the UK).

Of the Member States covered by the assessments, most (BE, ES, NL, PL, SK, EL, CZ, DE) apply GBRs to set emission limit values to air and/or water. These GBRs are not always consistent with BAT-AELs. One possible reason for such a discrepancy may be that, in certain Member States, modification of these GBRs involves a complex legal procedure (e.g. BE). However, it is not obvious that this is always the main reason why the GBRs are not commensurate with BAT-AELs.

In some Member States (NL, PL, DE, CZ) it is typical (or indeed required) to have a separate permit for discharges to water; this is typically because the Competent Authority is different from the authority responsible for other aspects of the permit (e.g. air, waste and noise). Coordination of competent authorities where more than one authority has responsibility for the permitting of the installation is required to ensure the integrated nature of IPPC implementation. Whilst in some Member States there seems to be good coordination between the various competent authorities involved in the permitting procedure, in others little evidence was provided to indicate the effective coordination of different authorities which may lead to inconsistencies when compared to Article 7 of the IPPC Directive.

Although all national legislation includes the requirement to use BAT, it is clear that, in eight out of 11 individual case study installations, ELVs are still set according to national legislation (GBRs) which often does not set ELVs consistent with the BAT-AELs, with consequent implications for actual emissions. For at least three out of the 11 case study installations the national legislation containing the relevant ELVs is the one transposing or implementing other EU legislation such as the LCP Directive or the NEC Directive including national programmes for reduction of emissions.

The Refineries BREF has not always been used in the setting of ELVs. The case studies in ES, EL, PL, SK and UK have identified that ELVs for emissions to air have been determined based on the requirements of legislation other than the IPPC Directive (national legislation/guidance, LCP Directive, 'National programme for reduction of emissions' under the NEC Directive, etc.). In at least three out of 11 case installations, the ELVs of the LCP Directive (or its transposition into national legislation) are imposed to limit the emissions from boilers, furnaces and heaters or from the installation as a whole[71].

Based on the data presented in Appendix H to this report, it is evident that none of the refineries considered has permit ELVs that are all consistent with the BAT-AELs. Many of the refineries permits assessed set emission limits as bubble values, making direct comparison against the process specific BAT-AELs impracticable (in some cases, the permit contained both a bubble value and point-source ELVs). Benchmark values do exist in the BREFs and it was clear in a number of cases that the Competent Authority had referred to these in setting limits and conditions within the permits. Based on the data available, the number of permit ELVs (covering all 11 installations) consistent with the BAT-AELs is 72. The same number (72) of permit ELVs were set higher than the BAT-AELs. For a large number (165) of permit ELVs, there is no corresponding or comparable BAT-AEL in the relevant BREFs[72].

In terms of the current performance of the installations assessed against BAT-AELs, the monitoring data provided suggests that none of the installations achieved all emissions within the BAT-AEL ranges. The use of different reporting parameters (e.g. use of mass values, bubble values and load values) caused difficulty in clearly comparing emissions against BAT-AELs as set out in the BREF. Seven installations were judged to have a mixed outcome, with certain emissions below the upper range of the BAT-AELs and others not. In four of the assessments it was unclear because the data provided for the installation was incomplete or not comparable to BAT-AELs.

- In terms of performance as compared to the BAT-AELs specified in the BREFs there is a mixed picture for seven installations (with some reported emissions consistent with the BAT-AELs and others not) and an unclear picture for the remaining four installations.

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71 For example, in one case, the LCPD ELVs have been imposed on individual boilers, furnaces and heaters. In another case, a load bubble has been imposed for all boilers, furnaces and heaters present in the refinery and covered by the LCP Directive through the National Emission Reduction Plan for existing LCPs.

72 These figures are based on the permit ELVs presented for the installations earlier in this chapter.

The table below provides an indicative summary of the BAT-AELs, permit ELVs and actual emissions to air and water for key pollutants of the refineries sector. This information is only intended to be indicative of the broad ranges of values observed in the various case studies and the reader is referred to the assessments for each installation for further information on the emissions from specific sources and the applicable permit ELVs and BAT-AELs.

Table 4.24 Indicative information on refineries for emissions of certain pollutants to air and water (BAT-AELs, permit ELVs and actual installation performance)

Member State	Pollutant	Source	BAT-AEL	Permit ELV	Actual emissions
Emissions to air					
BE	SO_2	Refinery concentration bubble	No comparable BAT-AEL	800 mg/Nm³	770 mg/Nm³
	NO_x	Refinery concentration bubble	No comparable BAT-AEL	300 mg/Nm³	220 mg/Nm³
	PM	Refinery concentration bubble	No comparable BAT-AEL	50 mg/Nm³	39 mg/Nm³
CZ *	SO_2	North flue duct	50 – 850 mg/Nm³	900 mg/Nm³	1-19 mg/Nm³
	NO_x	North flue duct	20 – 150 mg/Nm³	200 mg/Nm³	157-167 mg/Nm³
	SO_2	South flue duct	50 – 850 mg/Nm³	900 mg/Nm³	2-8 mg/Nm³
	NO_x	South flue duct	20 – 150 mg/Nm³	200 mg/Nm³	163-171 mg/Nm³
FR	SO_2	Refinery concentration bubble	No comparable BAT-AEL	1040 mg/Nm³ (Y)	837.5 mg/Nm³
	NO_x	Refinery concentration bubble	No comparable BAT-AEL	290 mg/Nm³ (Y)	221.6 mg/Nm³
	SO_2	Sulphur recovery unit 1	400 – 2000 mg/Nm³	14000 mg/Nm³	7152 mg/Nm³
	SO_2	Sulphur recovery unit 1	400 – 2000 mg/Nm³	20000 mg/Nm³	15639 mg/Nm³
	SO_2	Fluid catalytic cracking	10 – 350 mg/Nm³	4000 mg/Nm³	2385 mg/Nm³
	PM	Fluid catalytic cracking	10 – 40 mg/Nm³	50 mg/Nm³	117 mg/Nm³
DE	SO_2	Refinery load bubble	No comparable BAT-AEL	480 t/Mt	465 t/Mt
	NO_x	Refinery load bubble	No comparable BAT-AEL	390 t/Mt	355 t/Mt
EL1 *	SO_2	Existing LCPs under LCP Directive	50 – 850 mg/Nm³	1700 mg/Nm³	22 – 1594 mg/Nm³
	NO_x	Existing LCPs under LCP Directive	55 – 300 mg/Nm³	450 mg/Nm³	117 – 306 mg/Nm³
	PM	Existing LCPs under LCP Directive	5 – 30 mg/Nm³	100 mg/Nm³	3 – 84 mg/Nm³
	SO_2	Fluid catalytic cracking	10 – 350 mg/Nm³	200 mg/Nm³	83 – 900 mg/Nm³
	NO_x	Fluid catalytic cracking	100 – 300 mg/Nm³	150 mg/Nm³	19 – 299 mg/Nm³

Member State	Pollutant	Source	BAT-AEL	Permit ELV	Actual emissions
	PM	Fluid catalytic cracking	10 – 40 mg/Nm^3	50 mg/Nm^3	4.7 – 49.7 mg/Nm^3
EL2 *	SO_2	Refinery concentration bubble	No comparable BAT-AEL	1700 mg/Nm^3 (Y)	1431 mg/Nm^3
	NO_x	Refinery concentration bubble	No comparable BAT-AEL	450 mg/Nm^3 (Y)	375 mg/Nm^3
NL	SO_2	Refinery load bubble	50 – 230 t/Mt 50 – 210 t/Mt	1010 t/Mt	921 t/Mt
	NO_x	Refinery load bubble	20 – 150 t/Mt 80 – 170 t/Mt	397 t/Mt	237 t/Mt
PL *	SO_2	Refinery	No comparable BAT-AEL	1394.9 t/yr	2402.6 t/yr
	NO_x	Refinery	No comparable BAT-AEL	534.05 t/yr	1218.9 t/yr
	SO_2	Boilers	No comparable BAT-AEL	18369.5 t/yr	21567.9 t/yr
	NO_x	Boilers	No comparable BAT-AEL	4854.0 t/yr	7992.8 t/yr
	PM	Boilers	No comparable BAT-AEL	542.9 t/yr	1268.7 t/yr
SK *	SO_2	Fluid catalytic cracking	10 – 350 mg/Nm^3	1700 mg/Nm^3	102 mg/Nm^3
	NO_x	Fluid catalytic cracking	100 – 300 mg/Nm^3	700 mg/Nm^3	68 mg/Nm^3
	PM	Fluid catalytic cracking	10 – 40 mg/Nm^3	50 mg/Nm^3	36 mg/Nm^3
ES *	NO_x	Refinery concentration bubble – combustion only	No comparable BAT-AEL	616 mg/Nm^3	234 mg/Nm^3
	PM	Refinery concentration bubble – combustion only	No comparable BAT-AEL	150 mg/Nm^3	25 mg/Nm^3
Emissions to water					
BE	BOD	Wastewater treatment	2 – 20 mg/l	35 mg/l	< dl
	COD	Wastewater treatment	30 – 75 mg/l 30 – 125 mg/l	250 mg/l	33.6 mg/l
	Total-N	Wastewater treatment	1.5 – 25 mg/l	35 mg/l	9.5 mg/l
	SS	Wastewater treatment	2 – 30 mg/l 2 – 50 mg/l	60 mg/l	3.9 mg/l
FR	BOD	Wastewater treatment	2 – 20 mg/l	40 mg/l	17 – 51 mg/l
	COD	Wastewater treatment	30 – 75 mg/l 30 – 125 mg/l	150 mg/l	82 – 260 mg/l
	Total-N	Wastewater treatment	1.5 – 25 mg/l	30 mg/l	23 mg/l
	SS	Wastewater treatment	2 – 30 mg/l 2 – 50 mg/l	30 mg/l	5 – 27 mg/l
EL2	BOD	Wastewater treatment	2 – 20 mg/l	60 mg/l	23.1 mg/l

Member State	Pollutant	Source	BAT-AEL	Permit ELV	Actual emissions
	COD	Wastewater treatment	30 – 75 mg/l 30 – 125 mg/l	180 mg/l	174 mg/l
	SS	Wastewater treatment	2 – 30 mg/l 2 – 50 mg/l	70 mg/l	16.9 mg/l
	Total HC	Wastewater treatment	0.05 – 1.5 mg/l	12 mg/l	7.2 mg/l
NL	BOD	Wastewater treatment	2 – 20 mg/l	20 mg/l	15 mg/l
	COD	Wastewater treatment	30 – 75 mg/l 30 – 125 mg/l	200 mg/l	125.4 mg/l
PL	COD	Wastewater treatment	30 – 75 mg/l 30 – 125 mg/l	125 mg/l	47.8 mg/l
	Total-N	Wastewater treatment	1.5 – 25 mg/l	30 mg/l	2.7 mg/l
	SS	Wastewater treatment	2 – 30 mg/l 2 – 50 mg/l	35 mg/l	7.8 mg/l
SK	BOD	Wastewater treatment	2 – 20 mg/l	20 mg/l	5.2 mg/l
	COD	Wastewater treatment	30 – 75 mg/l 30 – 125 mg/l	80 mg/l	40.5 mg/l
	SS	Wastewater treatment	2 – 30 mg/l 2 – 50 mg/l	20 mg/l	10.9 mg/l
	Total HC	Wastewater treatment	0.05 – 1.5 mg/l	2 mg/l	0.14 mg/l
ES	BOD	Wastewater treatment	2 – 20 mg/l	300 mg/l	76 mg/l
	COD	Wastewater treatment	30 – 75 mg/l 30 – 125 mg/l	700 mg/l	226 mg/l
	SS	Wastewater treatment	2 – 30 mg/l 2 – 50 mg/l	250 mg/l	58 mg/l

* Comparison of performance against BAT-AELs and/or permit ELVs has been based on incomplete information on the averaging periods that apply, either because of inconsistencies between parameters (e.g. different averaging periods used for actual operation compared to BREF BAT-AELs) or because information on averaging periods was not provided. See the detailed assessments for more details.

Technical characteristics (e.g. age of the plant) and economic limitations and the apparent good quality of the local environment were stated by operators and/or competent authorities as a justification for not imposing ELVs within the BAT-AEL ranges; but the full rationale behind the choice for less stringent ELVs has not always been provided (so the number of cases where such approaches have been applied cannot be quantified). In some Member States, the operator has to propose ELVs in the permit application, sometimes including a justification why ELVs consistent with BAT-AELs are not feasible, and these propositions appear to have been implemented in the permit in most cases[73].

Site closure measures are not specifically addressed in the permit application and permit for the 10 of the 11 case study installations. In four cases, site closure measures are dealt with by GBRs but are limited to soil sanitation and proper disposal of waste. In only one case, specific site closure measures are included in the permit, though in several others there is a requirement for the operator to submit a site closure plan. In one case, the operator has already drafted such a plan. In cases where the operator does not own the land (e.g. FR, NL), specific clauses relating to site closure are sometimes formulated in the contract between operator and land owner.

In most Member States, monitoring requirements are defined in GBRs. The type of monitoring data provided and/or their format did not always allow for a check to be made against permit ELVs and/or BAT-AELs. Checking against BAT-AELs and/or benchmark values on an installation-wide level is also hampered by the existence of split views in the BREF conclusions.

Five out of 11 installations appear to be operating fully in line with their permit ELVs; while for five others there were one or more reported exceedances of the permit conditions (the situation was unclear for one installation). The emissions to air of a proportion of the installations assessed exceed the BAT-AELs, although the format in which emissions were reported did not always allow for a direct comparison against BAT-AELs to be made.

Although, in several installations, exceedances of permit ELVs have been identified, the competent authorities do not appear to have taken strong enforcement measures. Actions taken by the CAs were mostly limited to writing an official notification urging the operator to put an end to the exceedance. In some cases the operator was requested to provide a study on how the problem would be solved.

The setting of BAT-based ELVs in the refinery sector is often not straightforward as, in many cases, a petrochemical plant (covered by the large volume organic chemicals BREF) is linked to and heavily integrated with the refinery. Whereas in most cases a split of the emissions to air over both types of installations is possible, this is often not the case for wastewater where one wastewater treatment plant treats the wastewater of all units[74]. The numerous split views on BAT-AELs in the refineries BREF document also do not contribute to a swift translation into permit conditions. The existence of these split views has been used as a justification by certain CAs for not setting ELVs consistent with BAT-AELs on certain sources. Clearer conclusions in the updated BREF document would also be likely to help to ensure more consistent implementation of the Directive across the EU and to improve the usability of the BREF overall.

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73 It was not clear in all cases whether the competent authorities had undertaken their own BAT assessment.

74 In such cases, the BREF on common waste water treatment applies.

4.8 Overall conclusions

The following overall conclusions can be drawn when considering the sector wide analysis, the installation specific findings and the outcome of the workshop:

- The implementation of the IPPC Directive in the mineral oil and gas refineries sector has started relatively late and significant progress in the permitting process in some Member States has only been made over the last two to three years. This has been supported by the installation-specific findings and other work on review of permitting progress.

- All of the permits for the 11 case study installations include ELVs or equivalent parameters or technical measures or reference to GBRs.

- None of the installations had *all* ELVs contained in the permits consistent with the BAT-AELs. Of the 145 ELVs (for emissions to air as well as water) that could be assessed, 72 were consistent with the corresponding BAT-AELs, 72 were not and for 1 ELV it was unclear.

- From the installation-specific findings, it is clear that GBRs, which are sometimes based on the national transposition of other EU legislation such as the LCP Directive or the national programmes for reduction of emissions under the NEC Directive, are used to set ELVs for emissions to air in some Member States (such as PL, ES, EL)[75].

- Technical (e.g. age of the plant) and economic limitations and the apparent good quality of the local environment were stated by operators and/or competent authorities in some cases as a justification for not imposing ELVs that are consistent with the BAT-AEL ranges; but the full rationale behind the choice for less stringent ELVs has not always been provided (so the number of cases where such approaches have been applied cannot be quantified).

- In four of the eleven cases, the permit or other supporting documentation showed how BAT was taken into account in setting permit conditions. There were two cases where this was not the case, three cases where the picture was mixed and two cases where this was unclear.

- In 10 of the 11 cases, there was evidence of consideration of specific technical characteristics of the installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters. In some cases, this led to setting ELVs or other conditions that were either less or more stringent than BAT as specified in the BREFs. However, in other cases, whilst such factors were taken into account, this did not lead to setting less or more stringent conditions.

- In two of the cases, there was evidence of factors influencing permit conditions not compatible with the Directive (e.g. operator's economic circumstances).

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[75] Various other Member States apply GBRs in setting ELVs for emissions to water, as described previously.

- For 10 of the 11 installations the permit contained release monitoring requirements that covered the full requirements of Article 9(5)[76].

- None of the installations provided monitoring data indicating that all emissions were within the BAT-AEL ranges. For seven out of eleven installations, however, emissions to air and/or water were consistent with at least some of the BAT-AEL ranges, while for the remaining four the situation was unclear.

- As part of the general sector evaluation for the refineries sector, an analysis of the case study installations as well as emissions data from other sources was undertaken. This involved a consideration of the total emissions expressed as "load bubbles", both for individual installations and at a country-wide level[77]. The refineries BREF includes 'benchmarks' for emissions load bubbles. Whilst these benchmarks do not have the same status as BAT-AELs, they do provide a useful basis for comparisons between installations and between Member States. Key findings from this analysis include:

  - Regarding emissions to air, a wide variation of the measured load bubbles is obvious (as detailed earlier in this section), both for individual installations as well as on a country-wide level'[78]. Differences in the measured "load bubbles" cannot always be explained by refinery complexity and/or crude slate used. This suggests that legal requirements such as permit conditions set by Member States and/or GBRs also have a major influence on emissions to air.

  - Whilst it is apparent that progress in lowering the emissions to air has been made over recent years for SO_2 and NO_x, a significant number of installations are exceeding the load bubble benchmarks specified in the BREF document. This is confirmed by both the sector-wide analysis (80-90% of the installations exceed the SO_2 and 60-70% exceed the NO_x load bubble benchmarks) and the installation-specific findings.

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[76] Suitable release monitoring requirements, specifying measurement methodology and frequency, evaluation procedure and an obligation to supply the competent authority with data required for checking compliance with the permit.

[77] For several of the refineries, the "bubble concept" for setting refinery emission limit values has been applied (sometimes in conjunction with concentration-based limits). The refineries BREF does not include BAT-AELs for the bubble concept as the technical working group was not able to identify a single range of emissions associated with the application of BAT under the bubble concept. Instead, the BREF includes benchmark values proposed by one or more members of the technical working group. The bubble concept is a regulatory tool applied in several Member States and reflects a "virtual single stack" for the whole refinery (or a defined group of plants within the refinery). It is most frequently used for air emissions of SO_2 but is also applied to NO_x, dust, CO and metals. The bubble can be defined either as an average concentration (concentration bubble) or as a total mass emission per unit of throughput (load bubble). The treatment of waste water in the refinery is typically done in a single waste water treatment plant (for technical and economic reasons). Thus, regulation of water emissions by setting ELVs for the discharges from the WWTP can conceptually be regarded as a similar approach to the "bubble" for air emissions. In the general sector evaluation, estimated load bubbles for individual refineries and for Member States as a whole have been calculated based on publicly available data.

[78] By way of example, at a Member State level, the load bubbles for SO_2 varied from around 30 to 1,300 t/Mt throughput in 2006. The corresponding variation for NOx was 70 to 350 t/Mt throughput.

- Regarding emissions to water, concentrations and load bubbles also vary widely on an individual installation level, but a significantly larger share of installations already meet the load bubble benchmarks specified in the BREF document compared to the situation with emissions to air.

- Taking into account the late start-up of the implementation process for existing plants in most Member States and the fact that the implementation of certain measures has to take place during shut down or turnaround of installations, a further decrease of emissions may be expected for the coming years.

- Five out of eleven installations that were considered in the installation-specific assessment operate in line with all of their permit conditions for emission to air and water. Monitoring data provided indicate that a further five installations achieved emissions within some permit ELVs but not others.

- Provisions related to abnormal operating conditions, site closure measures, protection of soil and groundwater and monitoring of emissions were governed by GBRs in 7 out of 11 installations.

- The setting of BAT-based ELVs in the refinery sector is often not straightforward as in many cases a petrochemical plant (covered by the large volume organic chemicals BREF) is heavily integrated with the refinery. The numerous split views on BAT-AELs in the refineries BREF document also do not contribute to a swift/consistent use of the BREF's conclusions in setting permit conditions and this has been used as a justification not to impose ELVs in line with the BAT-AELs by certain competent authorities. Clearer conclusions in the updated refineries BREF document would therefore likely help to improve the usability of the BREF and thus to ensure a more consistent implementation of the IPPC Directive across the EU.

5. Conclusions

5.1 Overview

This section provides overall conclusions on the implementation of the IPPC Directive for the installation case studies covered and for the refineries sector.

For the 31 IPPC installations covered by this report, quantitative conclusions are drawn in relation to the questions asked regarding implementation of the IPPC Directive across all installations (mainly for those questions that form part of the assessment where a "yes" or "no" response can be given).

As set out previously in this report, the number of installations included within the study does not necessarily allow representative conclusions to be drawn "horizontally" at either the sector or Member State level. However, common or recurring themes have been drawn out where possible.

5.2 Quantitative conclusions on status of implementation for all installations

5.2.1 Overview

This section provides a summary, for all of the installations assessed as part of Tasks 2 and 3 of this study, of the status of implementation against the key questions from Section 2 of this report where a quantifiable result can be readily provided. For each of the questions, the number of installations meeting the requirements for implementation is indicated, along with a number of comments and key themes relevant to each of the questions.

An overall quantitative summary covering all of the installations is provided in Appendix H of this report.

The conclusions are based on the case study assessments presented in Sections 3 and 4 of this report[79].

[79] Further detail on these case studies is presented in Appendices A to F of this report. It should be noted that the assessments in Appendix F for the refineries sector include a comparison of permit ELVs and installation performance against both the BAT-AELs and the benchmarks in the refineries BREF. However, the assessments in Section 4 for the refineries sector and in this section only include quantitative conclusions when compared against the BAT-AELs (and not the benchmarks, which do not have the same status as BAT-AELs).

5.2.2 Assessment of permit determination procedures and permit conditions

Permit application

Permit issue date

The table below provides a summary of the date of issue of the main or most recent/relevant permit for the installations covered. It is of note that, for some of the installations, the permits were issued under previous regimes and may have been updated to reflect the requirement to comply with IPPC. In other cases, new permits have been issued in order to meet the requirements of the IPPC Directive.

Table 5.1 Summary of permit issue dates for installations covered in Tasks 2 and 3

Date	Number of installations
Prior to 2000	3
Between 2000 and 2005	6
2006	5
2007 – on or before 30 October	9
After 30 October 2007	8
Total	31

Note that the permit issue dates above do not necessarily imply that the installations did not have any environmental (or indeed integrated) permit prior to the dates stated.

In one case, the formal permit has not been issued and the CA/operator view and use the draft permit as if it applies officially.

As can be seen from the table above, it is evident that a significant number of the permits for the installations studied were only issued relatively recently (the assessments were undertaken mainly during the second half of 2008). This has implications for the extent to which it has been possible to assess performance of the installations against the conditions of their permit and also for the extent to which the requirement to comply with IPPC, through the permits, has influenced performance compared to BAT as set out in the BREFs.

As such, in some cases, full monitoring data that are comparable with the requirements of the permit have not been available (for example, where the permit was issued less than a year before the assessment was undertaken, a year's worth of relevant monitoring data has in some cases not been available).

Does the information provided by the applicant in relation to Article 6 appear to be comprehensive and accurate?

In quantitative terms, this has been interpreted to relate to whether all of the information required by Article 6 has been included in the operator's application for an IPPC permit (including in any additional information provided following requests from the competent authorities).

- Yes (or appears to) – 19 out of 31 installations.
- No – 11 out of 31 installations.
- Unclear – 1 out of 31 installations.

Issues related to the permit decision process

One of the main areas in cases where not of the aspects of Article 6 were covered relates to the main alternatives studied by the applicant (Article 6(1)(j))[80].

The case study assessments included consideration of issues such as: whether there was suitable dialogue between the operator and the Competent Authority during the permit determination process; whether co-ordination was required between Competent Authorities; whether there were any disagreements between the operator and Competent Authorities during permit development; and whether additional information was required prior to permit determination. The table below summarises the results of this analysis.

Table 5.2 Issues associated with permit decision process

	Yes	No	Mixed	Unclear
Was there suitable dialogue between the operator and the Competent Authority during the permit determination process?	29		1	1
Was co-ordination required between Competent Authorities?	26	4		1
Were there any disagreements between the operator and Competent Authorities during permit development?	12	15		4
Was additional information required prior to permit determination?	23	6		2

Whilst not necessarily statistically significant, the following conclusions can be drawn from these data, along with the timescales taken for permit development:

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80 It is noted that the applicant may not have studied any alternatives and, if this aspect is excluded, the total number covering all of the requirements of Article 6 would be greater.

- For installations where there were disagreements between the operator and competent authority, the average time taken for permit development was 15 months, compared to 8 months where there were no reported disagreements;
- For permit applications where additional information was required, the average time taken for permit development was 12 months, compared to 8 months where there was no reported need for additional information.

Permit conditions and permit determination process

Did the development meet the target timescales?

This relates to whether the permit development process (time between permit application and permit issue) met the target timescales set at a national level)[81]. There was considerable variation in the national target timescales, ranging from 1 month to 24 months.

- Yes or appears to – 15 out of 31 installations.
- No – 15 out of 31 installations.
- Unclear – 1 out of 31 installations.

In several cases, as detailed in the individual assessments, the competent authority has had to ask the operator to provide additional information to support their application because the initial information was deemed to be insufficient. This has led to delays in some cases in meeting the timescales (as highlighted above).

Another factor leading to the target timescales not being met was resource constraints amongst the competent authorities.

Does the permit include ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBRs (Article 9(8))

- Yes – 27 out of 31 installations.
- No – 0 out of 31 installations.
- Mixed – 4 out of 31 installations.

It is evident that the permits for the majority of installations include ELVs (or equivalent) or reference to relevant GBRs. In cases where the inclusion of ELVs is assessed as mixed, examples of the gaps include:

[81] No such timescale exists within the Directive, where the deadline for implementation of the Directive itself was set as 30 October 2007.

- In one case, ELVs were not set for one pollutant because no monitoring data were available.
- In one case, ELVs were not set for certain parts of the plant where these are due to close in the future (and operating hours are limited under the large combustion plants directive; the installation also has a temporary derogation from the requirement to operate in accordance with ELVs based on BAT under the relevant Accession treaty).
- For two of the nitric acid plants, no emission limit values were set for emissions of nitrous oxide (in one case because the emissions of this pollutant are considered to be low and in the other because testing of abatement techniques for this pollutant was ongoing).
- ELVs or equivalent parameters were set in all cases but in four cases they had not been set for certain key parameters (e.g. nitrous oxide emissions from nitric acid manufacture, as indicated above).
- All permits contained at least some ELVs in line with the corresponding BAT-AELs (either for emissions to air, water or both) with three installations having all ELVs in line with BAT-AELs.

Are emission limits for the installation consistent with BAT-AELs (where defined) in the relevant BREF documents?

Based on a review of all of the data presented in the preceding sections of the report, the numbers of installations that have set emission limits consistently with the BAT-AELs where these have been defined in the relevant BREF documents are as follows:

- Yes – 2 out of 31 installations (all permit ELVs where there is a corresponding BREF BAT-AEL are at or below the upper end of the BAT-AEL range).
- No – 0 out of 31 installations.
- Mixed – 29 out of 31 installations (these installations have at least one permit ELV that is at or below the upper end of the BAT-AEL range).

The data in Appendix H include a summary of the number of permit ELVs for each installation that appeared to be in line with (and the number that did not appear to be in line with) the corresponding BAT-AEL from the BREFs. This also includes the numbers where permit ELVs have been set but there is no corresponding BAT-AEL (marked not applicable) and the number of cases where it was unclear whether the permit ELVs are in line with the BAT-AELs (due, for example, to use of different units)[82]. In several cases, data were not provided on the averaging periods that apply to permit ELVs and/or monitoring data. Whilst the data provided have been used in this comparison, there are obviously inherent uncertainties given the lack of information on averaging periods.

[82] These results are mainly based on the analyses presented in Sections 3 and 4 of this report. Further information, mainly for processes at the installations which were not the primary focus of this study, are included in Appendices A to F (including further permit ELVs and monitoring data).

The only two installations where – based on the information provided – all permit ELVs were consistent with the corresponding BAT-AELs were the coal-fired LCP and nitric acid plant in the Netherlands.

Are the permit conditions relating to ELVs and the equivalent technical measures demonstrably based on BAT?

- Yes or appear to be – 4 out of 31 installations.
- No – 5 out of 31 installations.
- Mixed – 22 out of 31 installations.

As can be seen from the above, the extent to which permit conditions are demonstrably based on BAT is "mixed". In many cases, some of the permit ELVs are at or below the upper range of the BAT-AELs but some are not (the reasons for this differ significantly amongst the installations). In two cases, there was no indication of how the ELVs had been set in relation to BAT (and in one of these, all of the ELVs for the various air emission points were above BAT-AELs).

Does the permit or other supporting documentation show how BAT was taken into account in setting these conditions?

- Yes – 17 out of 31 installations.
- No – 3 out of 31 installations.
- Mixed – 6 out of 31 installations.
- Unclear – 5 out of 31 installations.

In the majority of cases, the relevant documentation either shows how BAT was taken into account for all ELVs or for some (i.e. "mixed" for the latter). With regard to those where this documentation does not show how BAT was taken into account, or where it is unclear, it should be noted that the level of information available for each of the installations is not necessarily comparable. For example, information was provided for some installations on the detailed rationale behind setting the permit conditions (i.e. a decision document) but not others. Likewise, the permit applications have not been made available in full for all of the installations[83]. However, it is clear in a number of cases that Member State interpretation of what BAT actually means in practice has led to discrepancies in implementation.

Have the relevant BREF documents been used in setting permit conditions?

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[83] In some cases, the application was shown to the assessors briefly at the site visit but not made available otherwise.

- Yes – 16 out of 31 installations.
- No – 6 out of 31 installations.
- Mixed – 4 out of 31 installations.
- Unclear – 5 out of 31 installations.

For the majority of installations (20), the BREFs have either been used to set all or some of the permit conditions. For those where it is unclear, this generally relates to cases where there is no information from the relevant documentation or site visits/interviews that shows how the BREFs have been taken into account. However, whilst the BREFs have been used, this does not necessarily mean that all of the ELVs set in the permit are commensurate with the BAT-AELs as indicated in the relevant BREF.

In some cases where the BREFs have not been used in setting permit conditions, national guidance or legislation has been used. Such guidance or legislation has, in some cases at least, been developed taking into account (though not necessarily transposing the main elements of) the BREFs.

Is there evidence of consideration of the specific technical characteristics of the installation, its geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?

- Yes – 25 out of 31 installations.
- No – 5 out of 31 installations.
- Unclear – 1 out of 31 installations.

Such characteristics appear to have been taken into account for the majority of installations. In many cases, assessments have been made of the impacts of emissions from the installation on local environmental quality and this has been taken into account when setting permit conditions. There are examples of where this has led to permit ELVs that that have been set above the upper end of the BAT-AEL ranges and where there has been, for example, reliance on minimum standards in national or Community sectoral legislation. There were also cases where ELVs have been set below the upper end of the BAT-AEL ranges due, for example, to local air quality problems to which the installation contributes (where the default approach would otherwise have been to set ELVs at the upper end of the BAT-AEL range).

It is noted that taking into account factors such as local environmental conditions appears to be interpreted in different ways for different installations. For example, the lack of an expected significant impact of an installation on the local environment was seen in some cases as a basis for setting permit ELVs that are above the upper end of the BAT-AEL ranges in the BREFs. Conversely, a potentially significant impact on the local environment, taking into account other sources of emissions, was used in some cases as a basis for setting stricter conditions than those that are achievable by the use of BAT as laid down in the BREFs.

Is there any evidence of factors influencing permit conditions not compatible with the Directive (e.g. operator's economic circumstances)?

- Yes – 5 out of 31 installations.
- No – 26 out of 31 installations.

Examples of where such factors appear to have influenced permit conditions include several cases where less stringent permit ELVs have been set due to the operator's own economic circumstances.

Does the permit contain release monitoring requirements that specify the full requirements of Article 9(5)?

- Yes – 23 out of 31 installations.
- No – 8 out of 31 installations.

This relates to specifying measurement methodology and frequency, evaluation procedure and an obligation to supply the competent authority with data required for checking compliance with the permit.

In some of the cases where this information is not included in the permit (i.e. "no" from above), reference has been made to GBRs that are reported to contain this information but where our assessment has not identified that all of these aspects are met (though the full details of all GBRs have not been translated or assessed in detail in all cases).

In one case, no information has been included on the methodology to be used for monitoring emissions to water. In another case, monitoring methods were specified in the operator's application but not in the permit.

Are the monitoring requirements sufficiently detailed?

- Yes – 20 out of 31 installations.
- No – 8 out of 31 installations.
- Unclear – 3 out of 31 installations.

One of the recurring examples of where monitoring requirements are not sufficiently detailed is in lack of information on averaging periods for monitoring. There are several cases where the BREFs do not include averaging periods and various case studies where the permits and/or monitoring data provided did not specify the averaging periods to be applied. This could cause difficulty in ensuring compliance with permit conditions and in any enforcement action deemed necessary.

In some cases where ELVs have not been set (see above), there are also no monitoring requirements and such cases are included in the "no" responses above.

Do the monitoring requirements take into account the details concerning monitoring contained within the BREF documents?

- Yes – 9 out of 31 installations.
- No – 5 out of 31 installations.
- Mixed – 6 out of 31 installations.
- Unclear – 11 out of 31 installations.

Does the permit include information on duration in relation to monitoring requirements?

- Yes – 24 out of 31 installations.
- No – 3 out of 31 installations.
- Mixed – 1 out of 31 installations.
- Unclear – 3 out of 31 installations.

In some cases where it is indicated in the above figures that information on duration is specified, this is actually set out in GBRs to which the permit refers, but not specifically within the permit.

Does the permit include measures relating to conditions other than normal operation? (Article 9(6))

- Yes – 23 out of 31 installations.
- No – 7 out of 31 installations.
- Mixed – 1 out of 31 installations.

Are there any GBRs implementing the IPPC Directive that govern control of the installation?

- Yes – 26 out of 31 installations.
- No – 5 out of 31 installations.

It is evident that, for the majority of the installations covered, GBRs apply to at least some aspects governing control of the installation. These take a variety of forms and in some cases include specific ELVs that apply directly to the installations and in others the GBRs apply to more procedural aspects (such as monitoring requirements).

The installations where no GBRs were identified that govern control of the installation were located in the UK, France and Spain (one installation).

Are there relevant Environmental Quality Standards that required stricter conditions than those achievable by the use of BAT?

- Yes – 3 out of 31 installations.
- No – 26 out of 31 installations.
- Unclear – 2 out of 31 installations.

Examples of cases where EQSs have led to setting stricter conditions include one installation required to use the techniques mentioned in the BREFs but at a larger scale/capacity than set out in the BREF[84] and one installation where a stricter limit was set for emissions to water to protect local river quality (the former relates to achieving a Community EQS and the latter a national EQS).

Is information on the period of validity of the permit included (as required under Article 13)?

- Yes – 22 out of 31 installations.
- No – 7 out of 31 installations.
- Unclear – 2 out of 31 installations.

In the majority of cases where information on the period of validity was not included in the permit itself, there were indications from the site visits and knowledge of national legislation/practice that there are procedures in place to review and update the permit conditions periodically.

The table below provides a breakdown of the period within which the permits must be reconsidered. This is based on those cases where the period of validity is explicitly mentioned in the permits and generally relates to the maximum period within which the permit must be reconsidered (in practice, permits may be considered more frequently and in many cases there are national rules on the frequency with which permits should be reconsidered, even if this is not explicitly stated in the permits). It is evident that permits will be reconsidered within 10 years for the majority of installations.

[84] For example, the Dutch LCP included a permit ELV for dust emissions to air at the bottom end of the BAT-AEL range (5-20 mg/Nm^3) and an ELV of 0.001 mg/l for mercury emissions to water (compared to the BAT-AEL of 0.01-0.02 mg/l).

Table 5.3 Frequency of permit reconsideration

Frequency of permit reconsideration	Number of installations
0-5 years	6
6-10 years	15
11 or more years	1
Not specified	9

Installations where the permit reconsideration period/date is explicitly mentioned within the permit itself. Permits may be reconsidered sooner due to e.g. substantial changes and permits for installations marked "not applicable" may be reconsidered based on national rules.

Are/were the application/decision document and permit available on a public register?

- Yes – 30 out of 31 installations.
- No – 1 out of 31 installations.

For the one installation, where all of this information is not available on a public register[85], a non-technical summary of the permit and the competent authority's decision are available to the public.

Are/were monitoring records made available to the public?

- Yes – 24 out of 31 installations.
- No – 1 out of 31 installations.
- Unclear – 6 out of 31 installations.

In some cases, the documentation is actively published whereas in others it must be requested from the competent authority. In the one case where this information is understood not to be made available to the public, it is believed that a review is being undertaken at the Member State and competent authority level to address this.

5.2.3 Assessment of the actual installation operation when compared to permit conditions and BAT

Emissions monitoring

Does the emission monitoring comply with the permit conditions?

85 In some cases, the documentation is actively published whereas in others it must be requested from the competent authority.

- Yes or appears to – 23 out of 31 installations.
- No – 0 out of 31 installations.
- Mixed – 6 out of 31 installations.
- Unclear – 2 out of 31 installations.

By way of example for the "mixed" cases, one of the installations is currently not applying continuous monitoring for one pollutant required in the permit; another has not undertaken monitoring for some sources.

Installation performance

Do the current emissions from the installation comply with the permit ELVs?

- Yes or appear to – 16 out of 31 installations.
- No – 0 out of 31 installations.
- Mixed (yes for some pollutants/data, no for others) – 12 out of 31 installations.
- Unclear – 3 out of 31 installations.

In the cases where the compliance with permit ELVs is "mixed", this generally relates to monitoring data suggesting that emissions of a small number of pollutants/sources are or have exceeded permit ELVs. In some cases, the monitoring data provided does not actually show breaches of these ELVs, such as where improvements have been made to achieve compliance with the ELVs. In the majority of these cases, most of the ELVs are met.

Cases where the results are mixed cover the majority of sectors covered, including fertilisers (2 installations), nitric acid (1), iron and steel (1), LCPs (3) and refineries (5).

Are current emissions from the installation consistent with BAT-AELs (where defined) in the relevant BREF documents?

- Yes or appear to be – 6 out of 31 installations.
- No – 0 out of 31 installations.
- Mixed – 20 out of 31 installations.
- Unclear – 5 out of 31 installations.

As can be seen from the figures above, emissions monitoring data from the majority of installations shows that emissions for some pollutants at least are consistent with the BAT-AELs (26 installations "yes" or "mixed"). However, only a small number of installations appear to have emissions that are all within the BAT-AELs. There is substantial variability amongst the installations falling into the mixed category (this includes installations where only one of several pollutant/source emissions are consistent with the BAT-AELs and others where the majority are consistent). However, as indicated earlier, four installations had no permit ELVs for certain key pollutants even though BAT-AELs are included in the BREFs.

Sanctions and ensuring compliance

Have sanctions or other measures been applied in cases of non compliance with the permit conditions?

- Yes – 6 out of 31 installations.
- No – 5 out of 31 installations.
- Not applicable – 14 out of 31 installations.
- Unclear – 6 out of 31 installations.

The range of sanctions applied varies significantly and some of those included in the figures above relate, for example, to fines levied for breaches of permit ELVs, but others relate to less stringent measures such as official warning letters (the latter have been used in the majority of cases). The mechanisms that exist or are available are generally fairly similar across the Member States.

Does the competent authority conduct on-site inspections?

- Yes – 28 out of 31 installations.
- No – 0 out of 31 installations.
- Unclear – 3 out of 31 installations.

For one of these installations, inspections had not been undertaken. This is understood to be because of significant ongoing changes at the installation making inspection difficult.

How many inspections have been undertaken in the past 12 months?

- None – 10 out of 31 installations (this includes two where this was not clear or not applicable[86]).
- Between one and three – 11 out of 31 installations.
- Four or more – 10 out of 31 installations.

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86 In the one case where this was not applicable, the installation was not yet operating, although a permit had already been issued.

In interpreting these figures, it should be noted that the inspection frequency in the past 12 months (prior to the site visit) may not necessarily be representative of the normal inspection frequency for the installation, due to the nature of activities undertaken at the installation in the year concerned (e.g. if improvement works were being undertaken).

Furthermore, the inspection frequency does not allow full conclusions to be drawn on the overall extent to which the competent authority ensures compliance, as it does not reveal information on duration or quality of inspections. For some installations covered by this assessment there are many inspections each year (in some cases more than ten) whereas others may have only one, although in one case this inspection was understood to have lasted for three months.

In general, inspections have been taken to include site visits that included some form of inspection of the plant and/or of information relating to operation of the plant vis a vis IPPC).

A summary of some of the key conclusions for each of the 31 installations covered in this study is provided in the table below.

Table 5.2 Summary of key findings for each permitted installation

Installation and reference number	1) Permit includes Emission Limit Values (ELVs) or equivalent?	2) Are ELVs consistent with BAT AELs?	3) Emissions consistent with BAT-AELs?	4) Emissions comply with permit ELVs?	5) Local conditions considered in setting conditions?	6) Permit available to the public?
Surface treatment (PCB manufacture)						
Italy (02/IT/18)	Mixed	Mixed	Mixed	Yes	No	Yes
United Kingdom (02/UK/25)	Yes	Mixed	Yes	Yes	Yes	Yes
Large combustion plant (coal and lignite fired)						
Greece (02/EL/12)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Italy (02/IT/22)	Yes	Mixed	Unclear	Unclear	Yes	Yes
Netherlands (02/NL/14)	Yes	Yes	Yes	Mixed	Yes	Yes
Poland (02/PL/30)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Slovakia (02/SK/15)	Mixed	Mixed	Mixed	Yes	Yes	Yes
Spain (02/ES/33)	Yes	Mixed	Mixed	Mixed	Unclear	Yes
United Kingdom (02/UK/34)	Yes	Mixed	Mixed	Yes	Yes	Yes
Iron and steel (blast furnace and sinter plant)						
Italy (02/IT/29)	Yes	Mixed	Yes	Yes	Yes	Yes
Netherlands (02/NL/02)	Yes	Mixed	Mixed	Mixed	Yes	Yes

Installation and reference number	1) Permit includes Emission Limit Values (ELVs) or equivalent?	2) Are ELVs consistent with BAT AELs?	3) Emissions consistent with BAT-AELs?	4) Emissions comply with permit ELVs?	5) Local conditions considered in setting conditions?	6) Permit available to the public?
Slovakia (02/SK/03)	Yes	Mixed	Mixed	Yes	Yes	Yes
Spain (02/ES/31)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Nitric acid manufacture						
Italy (02/IT/09)	Mixed	Mixed	Mixed	Yes	No	Yes
Netherlands (02/NL/28)	Yes	Yes	Yes	Mixed	Yes	Yes
Spain (02/ES/32)	Mixed	Mixed	Mixed	Yes	Yes	Yes
Fertiliser (NPK/CN manufacture)						
Italy (02/IT/23)	Yes	Mixed	Yes	Yes	No	Yes
Netherlands (02/NL/24)	Yes	Mixed	Yes	Yes	No	Yes
Slovakia (02/SK/07)	Yes	Mixed	Mixed	Unclear	Yes	Yes
Spain (02/ES/08)	Yes	Mixed	Mixed	Yes	Yes	Yes
Oil and gas refineries						
Belgium (03/BE/13)	Yes	Mixed	Unclear	Yes	Yes	Yes
Czech Republic (03/CZ/02)	Yes	Mixed	Mixed	Mixed	Yes	No
France (03/FR/12)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Germany (02/DE/16)	Yes	Mixed	Mixed	Mixed	No	Yes
Greece (03/GR/14)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Greece (03/GR/17)	Yes	Mixed	Unclear	Unclear	Yes	Yes
Italy (03/IT/15)	N/A	N/A	N/A	N/A	N/A	N/A
Netherlands (03/NL/07)	Yes	Mixed	Unclear	Yes	Yes	Yes
Poland (03/PL/08)	Yes	Mixed	Unclear	Yes	Yes	Yes
Slovakia (03/SK/09)	Yes	Mixed	Mixed	Yes	Yes	Yes
Spain (03/ES/10)	Yes	Mixed	Mixed	Yes	Yes	Yes
United Kingdom (03/UK/11)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Totals						
Yes	27	2	6	16	25	30
No	0	0	0	0	5	1
Mixed	4	29	20	12	N/A	N/A
Unclear	N/A	0	5	3	1	0
Total	31	31	31	31	31	31

Installation and reference number	1) Permit includes Emission Limit Values (ELVs) or equivalent?	2) Are ELVs consistent with BAT AELs?	3) Emissions consistent with BAT-AELs?	4) Emissions comply with permit ELVs?	5) Local conditions considered in setting conditions?	6) Permit available to the public?

Note: Full questions were as follows:

1) Does the permit include ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBRs (Article 9(8))?

2) Are emission limits from the installation consistent with BAT-AELs (where defined) in the relevant BREF documents?

3) Are current emissions from the installation consistent with BAT-AELs (where defined) in the relevant BREF documents?

4) Do the current emissions from the installation comply with the permit ELVs?

5) Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?

6) Are/were the application/decision document and permit available on a public register?

5.3 Key issues for sectors and Member States

5.3.1 Overview

This section provides a brief commentary on some of the issues identified with regard to implementation of the IPPC Directive for the case study installations investigated for Tasks 2 and 3 of this study, both in terms of the sectors (excluding refineries which are considered in the following section) and in terms of the Member States covered. The main points include comments on common or recurring themes or on key observations regarding the installations covered.

Further details on key conclusions for specific sectors are included in Sections 3 and 4 of this report.

As noted previously in this report, given the relatively limited number of installations covered as compared to the total included under the IPPC Directive, it is not possible in most cases to draw conclusions that are necessarily representative of implementation of the Directive across a sector or a Member State. Rather, the information presented here may provide an indication for the Commission, Member States and industry of further work that could be done to further implement, or to support implementation of, the IPPC Directive.

5.3.2 Permit application and determination process

Our analysis shows that:

- Permit applications produced by operators generally contain relevant information to meet the requirements of Article 6. However, it is clear that in most Member States, the competent authorities have been required to formally request additional information in order to effectively determine the process; reasons given include:

- Lack of clear guidance to operators on what information is deemed adequate to determine the permit conditions;

- Many applications covered by this study were made relatively near to the start of the permitting process within the Member States concerned (though not necessarily early compared to the overall timescale between adoption of the IPPC Directive and the implementation deadline for existing installations). Therefore there was a degree of learning involved (i.e. subsequent applications improved in information quality) – this is most relevant for Member States that have chosen to issue multiple permits for single sites, such as Slovakia.

- A majority of the applications assessed were for complex industrial installations, where a significant level of detail was required on a number of new areas (energy, resource efficiency, water use, waste).

• The determination process for most Member States was set against nationally defined target timescales. Almost half of the permits assessed did not meet these national target timescales – the reasons being given included:

  - The case studies chosen were, in some cases, high profile and generated a lot of public interest and comments. These required addressing prior to permit issue, often involving more than one public consultation therefore extending the determination period.

  - Five of the case study permits assessed did not meet the deadline of 30 October 2007. Amongst the qualitative reasons given were a lack of technical resources, difficulty in coordinating between numerous competent authorities and the adoption of a sectoral approach to permitting that led to delays.

• Across Member States, a large proportion of the operators interviewed indicated that they had used the relevant BREF documents, often producing a technical study of the installation against BAT in their applications.

• There was widespread use by competent authorities of the operators' BAT comparisons within their application in order to assess BAT. Although a number of competent authorities referred to the use of BREF documents, there was generally little evidence of this within the permits themselves.

5.3.3 Permit conditions and emission limits

• The majority of permits assessed contained ELVs in relation to the key air and/or water emissions (as described above). For those where no ELVs were given, there was no commonality in the rationale for this in each instance. Examples of why ELVs were not included in permits were: the plant was subject to derogation from the IPPC or LCP Directive under the relevant Accession Treaty or opt-out under the LCP Directive and there was insufficient monitoring data for the competent authority to set permit limits. The Commission considers that, except in cases of temporary derogations from the application of BAT under the IPPC Directive granted under the Accession Treaty, these are not valid reasons for not setting permit conditions for the relevant pollutants.

- ELVs given in permits demonstrated a mixed level of correlation with BAT-AELs. Some permits had several ELVs based on BAT and some had few, if any. Reasons mentioned for this include:
  - ELVs are set at a national level within GBRs and are therefore not always based on BAT-AELs[87];
  - ELVs within national GBRs are based on limits set out in legislation other than the IPPC Directive (e.g. the LCP Directive) and in the case where such limits are given, these are used in preference to setting BAT-based ELVs;
  - The BAT-AELs given in some of the BREF documents are considered by some of those interviewed as part of this study as being unclear and there is often substantial resistance to direct use of these values by the operators on the grounds of technical and/or local factors;
  - It is not a legal requirement to comply with the BREF documents and therefore the legality of BAT-AELs is questionable;
  - Based on an assessment of the local environmental conditions, the setting of ELVs at a level within the BAT-AEL range is not required in order to protect the environment and human health.
- Around a quarter of permits assessed do not contain conditions relating to non-normal operation and therefore are not fulfilling the requirements of Article 9(6). This was seen in some of the UK, Italy, Belgium, Netherlands and Spanish permits.
- The majority of permits contained monitoring conditions that met the requirements of Article 9(5). Where conditions were not included, there was no commonality as to the reasons for the omission. In the majority of cases, the BREFs were not used to set these conditions (or it was unclear how they were used).
- There was clear evidence in the majority of cases that the application and permit were available to members of the public.

5.3.4 Installation performance and compliance with permit

- Based on the data provided, over 40% of the case studies examined had some permit ELVs that had not been met in all cases (see for example Section 3 of this report for further information);
- Based on the data provided, the performance of the installations when assessed against BAT-AELs as given in the BREF documents generally presented a mixed picture, with around 20% of the installations fully meeting BAT-AELs and the remainder meeting some but not all.
- There was clear evidence presented across most Member States that the competent authorities conduct on-site inspections of IPPC installations. Where inspections had not been undertaken, the reasons given by respondents included:

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[87] The rationale behind setting ELVs in GBRs has not generally been reviewed as part of this study.

- A lack of resources;
- The permit was recently issued and therefore there has been little time to prepare for inspections;
- The inspections are undertaken by a separate competent authority division and the respondent was unclear as to how many had been undertaken.

5.4 Summary of overall conclusions for refineries

Section 4 of this report presents the outputs of an assessment of the implementation of the IPPC Directive in the mineral oil refineries sector, both in terms of the findings for the case study installations included in this study and in terms of a general sector evaluation. The main conclusions, based on both of these, are set out below[88].

- The implementation of the IPPC Directive in the mineral oil and gas refineries sector started relatively late and, based on the installations assessed, significant progress in the permitting process in some Member States was only made in the period 2006 to 2008. This is supported by the installation-specific findings and other work on review of permitting progress.
- All of the permits for the 11 case study installations include ELVs or equivalent parameters or technical measures or reference to GBRs.
- None of the installations had *all* ELVs contained in the permits consistent with the BAT-AELs. Of the 145 ELVs (for emissions to air as well as water) that could be assessed, 72 were consistent with the corresponding BAT-AELs, 72 were not and for 1 ELV it was unclear.
- From the installation-specific findings, it is clear that GBRs – which are sometimes based on the national transposition of other EU legislation such as the LCP Directive or the national programmes for reduction of emissions under the NEC Directive – are used to set ELVs for emissions to air in some Member States considered (PL, ES, EL).
- Technical (e.g. age of the plant) and economic limitations and the apparent good quality of the local environment were stated by operators and/or competent authorities in some cases as a justification for not imposing ELVs that are consistent with the BAT-AEL ranges; but the full rationale behind the choice for less stringent ELVs has not always been provided (so the number of cases where such approaches have been applied cannot be quantified). In some Member States, the operator has to propose ELVs in the permit application, sometimes including a justification why ELVs consistent with BAT-AELs are not feasible, and these propositions appear to have been implemented in the permit in most cases.

88 It is noted that the analysis of only one permit per Member State for the refinery sector (two in Greece) does not necessarily allow for representative conclusions to be drawn on the implementation of the IPPC Directive in the mineral oil and gas refineries sector for those specific Member States.

- In four of the eleven cases, the permit or other supporting documentation showed how BAT was taken into account in setting permit conditions. There were two cases where this was not the case, three cases where the picture was mixed and two cases where this was unclear.

- In 10 of the 11 cases, there was evidence of consideration of specific technical characteristics of the installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters. In some cases, this led to setting ELVs or other conditions that were either less or more stringent than BAT as specified in the BREFs. However, in other cases, whilst such factors were taken into account, this did not lead to setting less or more stringent conditions.

- In two of the cases, there was evidence of factors influencing permit conditions not compatible with the Directive (e.g. operator's economic circumstances).

- For 10 of the 11 installations the permit contained release monitoring requirements that covered the full requirements of Article 9(5)[89].

- None of the installations provided monitoring data indicating that all emissions were within the BAT-AEL ranges. For seven out of eleven installations, however, emissions to air and/or water were consistent with at least some of the BAT-AEL ranges, while for the remaining four the situation was unclear.

- Five out of eleven installations that were considered in the installation-specific assessment operate in line with all of their permit conditions for emission to air and water. Monitoring data provided indicate that a further five installations achieved emissions within some permit ELVs but not others.

- As part of the general sector evaluation for the refineries sector, an analysis of the case study installations as well as emissions data from other sources was undertaken. This involved a consideration of the total emissions expressed as "load bubbles", both for individual installations and at a country-wide level[90,]. Key findings from this analysis include:

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89 Suitable release monitoring requirements, specifying measurement methodology and frequency, evaluation procedure and an obligation to supply the competent authority with data required for checking compliance with the permit.

90 For several of the refineries, the "bubble concept" for setting refinery emission limit values has been applied (sometimes in conjunction with concentration-based limits). The refineries BREF does not include BAT-AELs for the bubble concept as the technical working group was not able to identify a single range of emissions associated with the application of BAT under the bubble concept. Instead, the BREF includes benchmark values proposed by one or more members of the technical working group. The bubble concept is a regulatory tool applied in several Member States and reflects a "virtual single stack" for the whole refinery (or a defined group of plants within the refinery). It is most frequently used for air emissions of SO_2 but is also applied to NO_x, dust, CO and metals. The bubble can be defined either as an average concentration (concentration bubble) or as a total mass emission per unit of throughput (load bubble). The treatment of waste water in the refinery is typically done in a single waste water treatment plant (for technical and economic reasons). Thus, regulation of water emissions by setting ELVs for the discharges from the WWTP can conceptually be regarded as a similar approach to the "bubble" for air emissions. In the general sector evaluation, estimated load bubbles for individual refineries and for Member States as a whole have been calculated based on publicly available data.

- The refineries BREF includes 'benchmarks' for emissions load bubbles. Whilst these benchmarks do not have the same status as BAT-AELs,it is clear that some installations have permit ELVs set on the basis of these benchmarks.

- Regarding emissions to air, a wide variation of the total emissions expressed as "load bubbles" is obvious, both for individual installations as well as on a country-wide level[91]. Differences in the measured "load bubbles" cannot always be explained by refinery complexity and/or crude slate used. This suggests that legal requirements such as permit conditions set by Member States and/or GBRs also have a major influence on emissions to air.

- Whilst it is apparent that progress in lowering the emissions to air has been made over recent years for SO_2 and NO_x, a significant number of installations are exceeding the annual load bubble benchmarks specified in the BREF document. This is confirmed by both the sector-wide analysis (80-90% of the installations exceed the SO_2 and 60-70% exceed the NO_x load bubble benchmarks) and the installation-specific findings.

- Regarding emissions to water, concentrations and load bubbles also vary widely on an individual installation level, but a significantly larger share of installations already meet the load bubble benchmarks specified in the BREF document compared to the situation with emissions to air.

• Provisions related to abnormal operating conditions, site closure measures, protection of soil and groundwater and monitoring of emissions were governed by GBRs in seven out of eleven installations.

• The setting of BAT-based ELVs in the refinery sector is often not straightforward as in many cases a petrochemical plant (covered by the large volume organic chemicals BREF) is heavily integrated with the refinery. The numerous split views on BAT-AELs in the refineries BREF document also do not contribute to a swift/consistent use of the BREF's conclusions in setting permit conditions and this has been used as a justification not to impose ELVs in line with the BAT-AELs by certain competent authorities. Clearer conclusions in the updated refineries BREF document would therefore be likely to help improve the usability of the BREF and thus to ensure a more consistent implementation of the IPPC Directive across the EU.

A summary of the conclusions for each of the refineries against key questions is provided below.

[91] By way of example, at a Member State level, the load bubbles for SO_2 varied from around 30 to 1,300 t/Mt throughput in 2006. The corresponding variation for NOx was 70 to 350 t/Mt throughput.

Table 5.3 Summary of key findings for each permitted installation in the refineries sector

Installation and reference number	1) Permit includes Emission Limit Values (ELVs) or equivalent?	2) Are ELVs consistent with BAT AELs?	3) Emissions consistent with BAT-AELs?	4) Emissions comply with permit ELVs?	5) Local conditions considered in setting conditions?	6) Permit available to the public?
Belgium (03/BE/13)	Yes	Mixed	Unclear	Yes	Yes	Yes
Czech Republic (03/CZ/02)	Yes	Mixed	Mixed	Mixed	Yes	No
France (03/FR/12)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Germany (02/DE/16)	Yes	Mixed	Mixed	Mixed	No	Yes
Greece (03/GR/14)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Greece (03/GR/17)	Yes	Mixed	Unclear	Unclear	Yes	Yes
Italy (03/IT/15)	N/A	N/A	N/A	N/A	N/A	N/A
Netherlands (03/NL/07)	Yes	Mixed	Unclear	Yes	Yes	Yes
Poland (03/PL/08)	Yes	Mixed	Unclear	Yes	Yes	Yes
Slovakia (03/SK/09)	Yes	Mixed	Mixed	Yes	Yes	Yes
Spain (03/ES/10)	Yes	Mixed	Mixed	Yes	Yes	Yes
United Kingdom (03/UK/11)	Yes	Mixed	Mixed	Mixed	Yes	Yes
Totals						
Yes	11	0	0	5	10	10
No	0	0	0	0	1	1
Mixed	0	11	7	5	N/A	N/A
Unclear	N/A	0	4	1	0	0
Total	11	11	11	11	11	11

Note: Full questions were as follows:

1) Does the permit include ELVs or equivalent parameters or technical measures (Article 9(3)) or reference to GBRs (Article 9(8))?

2) Are emission limits from the installation consistent with BAT-AELs (where defined) in the relevant BREF documents?

3) Are current emissions from the installation consistent with BAT-AELs (where defined) in the relevant BREF documents?

4) Do the current emissions from the installation comply with the permit ELVs?

5) Is there evidence of consideration of specific technical characteristics of installation, geographic location or local environmental conditions in the setting of emission limit values and equivalent technical parameters?

6) Are/were the application/decision document and permit available on a public register?

5.4.1 Limitations and uncertainties

Whilst all reasonable efforts have been made to undertake the assessments of individual installations and to obtain all of the information in the data collection templates developed for this project, there are a number of factors that

have influenced the level of information that is available and hence the extent to which full conclusions can be drawn. These include:

- Limitations on the amount of time available for investigating each issue for each installation. Whilst the desk-based reviews prior to site visits in most cases allowed the site visit interviews to focus on the main outstanding issues, in several cases, information needed for the assessments was either only made available at the time of the site visit or made available afterwards, allowing less opportunity to explore specific issues. This also means that the level of information available for the different installations varies.

- Some of the sectors and installations studied are highly complex. Furthermore, the processes for permitting of some of these installations prevented the undertaking of a full assessment of all aspects of the installation (for example, there are several tens of IPPC permits for some of the individual installations examined and these could not all reasonably be reviewed within the time and resources available).

- There was significant variability amongst the case study installations in the availability, transparency and quality of the data provided. In particular:

  - Applications and permit decision documents were made available for some, but not all, of the installations (in some cases, the applications were made in the 1990s; for some installations no formal decision documents exist).

  - Similarly, the level of information available on emissions monitoring was highly variable. In some cases, emissions data available from the competent authorities only included total mass emissions to air and water and in several cases the data provided in permits and on actual emissions did not include details of the averaging periods used, both of which make comparison of emissions with permit ELVs and BAT-AELs problematic. In some cases, competent authorities did not have more detailed monitoring data whilst in others there was a reluctance to provide such data (however, in most cases, the competent authority and/or the operator were happy to provide data). Furthermore, in some cases, the monitoring data provided related to a period before the currently applied permit ELVs were introduced.

  - Furthermore, the permits themselves varied considerably in terms of level of detail. As can be seen from the quantitative conclusions above, a number of the installations were bound by general binding rules rather than specific permit conditions. Whilst many of these GBRs were reviewed, it was not possible to undertake a full review of all conditions of all of these GBRs (especially where translation was necessary).

- The case study assessments are, in most cases, not sufficient in number to allow any representative conclusions to be drawn regarding implementation of the Directive at a sector or Member State level. However, the findings of the case studies may serve as a basis for identifying areas where further investigation or support are required.

Furthermore, it should be recognised that this study does not constitute a check on compliance with the Directive and none of the findings of this report have been produced with the intention of instigating or informing any legal proceedings. With this in mind references to individual installations or employees of such installations have been excluded from the report.

6. References

Best available techniques reference documents (BREFs):

- Reference document on best available techniques for mineral oil and gas refineries (February 2003).
- Best available techniques reference document on the production of iron and steel (December 2001).
- Reference document on best available techniques for the manufacture of large volume inorganic chemicals – ammonia, acids and fertilisers (August 2007).
- Reference document on best available techniques for large combustion plants (July 2006).
- Reference document on best available techniques for the surface treatment of metals and plastics (August 2006).
- Reference document on best available techniques on surface treatment using organic solvents (August 2006).
- Reference document on economics and cross-media effects (July 2006).
- Reference document on the general principles of monitoring (July 2003).

Concawe (1994): Sulphur dioxide emissions from oil refineries and combustion of oil products in Western Europe (1992); Report no. 6/94, 40 pp.

Concawe (1998): Sulphur dioxide emissions from oil refineries and combustion of oil products in Western Europe and Hungary (1995); Report no. 3/98, 29 pp.

Concawe (2002): Sulphur dioxide emissions from oil refineries and combustion of oil products in Western Europe and Hungary (1998); Report no. 10/02, 32 pp.

Concawe (2004): Trends in oil discharged with aqueous effluents from oil refineries in Europe; Report no. 4/04, 10 pp.

Concawe (2007): Sulphur dioxide emissions from oil refineries and combustion of oil products in Western Europe and Hungary (2002); Report no. 2/07, 29 pp.

EPER (2001): Data from the EPER database for the reference year 2001.

EPER (2004): Data from the EPER database for the reference year 2004.

IVL (2005): Allowance allocation and CO2 intensity of the EU15 and Norwegian refineries.

Kirk Othmer (2005): Nitric acid, Kirk-Othmer Encyclopedia of Chemical Technology.

OGJ (2001): 2001 Worldwide refining survey; Oil & Gas Journal, Dec. 24, 2001.

Vito (2008): Beste beschikbare technieken voor beperking en behandeling van afvalwater van raffinaderijen; Report 2008/IMS/R/, 127 pp + annexes.

7. Glossary of acronyms

BAT	Best available techniques (as defined in Article 2(12) of the IPPC Directive)
BAT-AEL	BAT-associated emission level
BREF	Best available techniques (BAT) reference document
CA	Competent authority
CLRTAP	Convention on long-range transboundary air pollution
CN	Calcium Nitrate $Ca(NO_3)_2$ (and fertilisers based thereon)
CO	Carbon monoxide
COS	Carbonyl sulphide
DAA	Directly associated activity (as defined in Article 2(3) of the IPPC Directive)
EIA	Environmental impact assessment
ELV	Emission limit value (as defined in Article 2(6) of the IPPC Directive)
EMEP	European Monitoring and Evaluation Programme
EPER	European pollutant emission register
EQS	Environmental quality standard
ESP	Electrostatic precipitator
ETS	Emissions trading scheme
EU	European Union
EU15	European Union Member States prior to 2004 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK)
EU25	European Union Member States prior to 2007 (as EU15 plus Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia)
EU27	European Union Member States after 2007 (as EU25 plus Bulgaria, Romania)
FGD	Flue gas desulphurisation

GBR	General binding rule (provided for in Article 9(8) of the IPPC Directive). The definition applied herein is "limit values or other conditions (defined in particular in environmental laws, regulations and ordinances) at sector level or wider, that are given with the intention to be used directly to set permit conditions. They provide direct conditions or minimum standards. GBRs are binding either to the authority or to the operator. However, under certain conditions, some general rules may not be mandatory and deviation will be allowed, although the normal expectation would be that the rules be used directly." (Based on a report for the European Commission conducted during the review of the IPPC Directive.)
HCl	Hydrogen chloride
HF	Hydrogen fluoride
IPPC	Integrated pollution prevention and control
JRC	Joint Research Centre
LCP	Large combustion plant
LDAR	Leak detection and repair
LVIC	Large volume inorganic chemicals
MoE	Ministry of Environment
MS	Member State
N/A	Not applicable
NCI	Nelson complexity index
NEC	National emission ceilings (Directive)
NeR	Netherlands emission guidelines for air
NH_3	Ammonia
NMVOC	Non-methand volatile organic compound
NO_x	Nitrogen oxides
NPC	Nameplate capacity
NPK	Compound/multinutrient fertiliser (based on nitrogen, phosporus, potassium)
PCB	Printed circuit board
PM	Particulate matter

SCR	Selective catalytic reduction
SME	Small and medium sized enterprises
SO_2	Sulphur dioxide
SNCR	Selective non-catalytic reduction
TOC	Total organic carbon
VOC	Volatile organic compound
VRU	Vapour recovery unit
WWTP	Wastewater treatment plant

Member State abbreviations

AT	Austria
BE	Belgium
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
FR	France
HU	Hungary
IE	Ireland
IT	Italy
LT	Lithuania
LV	Latvia
LU	Luxembourg

MT	Malta
NL	Netherlands
PL	Poland
PT	Portugal
SE	Sweden
SI	Slovenia
SK	Slovakia (Slovak Republic)
UK	United Kingdom

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Appendix A
Reporting templates – surface treatment (PCB manufacture)

This appendix contains the detailed assessment reports for the installations in the **surface treatment of metals and plastic** sector (printed circuit board manufacture). It includes the following appendices:

Appendix A1. Italy

Appendix A2. United Kingdom

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Appendix B
Reporting templates – coal fired power plants

This appendix contains the detailed assessment reports for the installations in the **large combustion plants** sector (coal and lignite fired power plants). It includes the following appendices:

Appendix B1. Greece

Appendix B2. Italy

Appendix B3. Netherlands

Appendix B4. Poland

Appendix B5. Slovakia

Appendix B6. Spain

Appendix B7. United Kingdom

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Appendix C
Reporting templates – iron and steel production

This appendix contains the detailed assessment reports for the installations in the **iron and steel production** sector (sinter plant and blast furnace). It includes the following appendices:

Appendix C1. Italy

Appendix C2. Netherlands

Appendix C3. Slovakia

Appendix C4. Spain

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Appendix D
Reporting templates – nitric acid manufacture

This appendix contains the detailed assessment reports for the installations in the **nitric acid manufacture** sector. It includes the following appendices:

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Appendix E
Reporting templates – fertiliser manufacture

This appendix contains the detailed assessment reports for the installations in the **NPK/CN fertiliser manufacture** sector. It includes the following appendices:

Appendix E1. Italy

Appendix E2. Netherlands

Appendix E3. Slovakia

Appendix E4. Spain

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Appendix F
Reporting templates – mineral oil and gas refineries

This appendix contains the detailed assessment reports for the installations in the **mineral oil and gas refineries** sector. It includes the following appendices:

Appendix F1. Belgium

Appendix F2. Czech Republic

Appendix F3. France

Appendix F4. Germany

Appendix F5. Greece (1 of 2)

Appendix F6. Greece (2 of 2)

Appendix F7. Italy (not included; no assessment undertaken)

Appendix F8. Netherlands

Appendix F9. Poland

Appendix F10. Slovakia

Appendix F11. Spain

Appendix F12. United Kingdom

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Appendix G
Additional information for the refineries sector

The information provided below includes additional detail to support the refineries general sector evaluation in Section 5 of the main report.

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Appendix H
Quantitative results for Tasks 2 and 3

The table overleaf provides a quantitative summary for each of the installations covered under Tasks 2 and 3 of this study of the status of implementation. As detailed elsewhere within this report, the specific identity of the installations is not relevant for this study and the work has not been undertaken as a check on compliance with the IPPC Directive.

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