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Agenda
Integrated permits for oil refineries: training mission 2
Act. 4.2.d.2
6th – 9th of May 2013

MS Experts: Joan Ramon Cabello, Luis Suárez (Spain)

AGENDA

Monday 6th of May

- 09:30 – 12:30
  - Introduction to training materials and methodology of this training mission.
  - Description of the unit based on the documentation provided.
- 12:30 – 13:30 Lunch break
- 13:30 – 17:30:
  - Preparation of sections of the permit application: Air emissions section.

Tuesday 7th of May

- 09:30 – 12:30
  - Preparation of sections of the permit application:
    - Waste management.
    - Wastewater discharges.
- 12:30 – 13:30 Lunch break
- 13:30 – 17:30
  - Preparation of sections of the permit application:
    - Soil & groundwaters.
    - Inspections & monitoring plan.

Wednesday 8th of May

- 09:30 – 12:30
  - Preparation of sections of the permit application: Annex on BATs.
- 12:30 – 13:30 Lunch break
- 13:30 – 17:00
  - Presentation of the permit application completed by the Spanish experts and comparison with the sections prepared by the participants in the previous days.

3.- CASE STUDY AGENDA

3.1.- Monday 6th of May

3.1.1.- 09:30 – 12:30

- Introduction to training materials and methodology of this training mission.
- Description of the unit based on the documentation provided.

The main objective of the training is to check if the information provided is enough to prepare and fulfill the permit application, complete the information if it is necessary and finally build an appropriate application example.

To achieve this objective all the information described in points 1 and 2 of this document must be read carefully and understood.

- Is any more information necessary? Check-list to make sure the information is complete: The first step is to check that the application contains all the information needed to carry out the administrative procedure. There are several ways of doing it. Comment how you would implement it in your organization, considering the present situation on administrative procedures.
- Confidential information: The applicant has reported that all the information provided is confidential. Comment how to deal with this situation.
- It is not clearly stated in the Directive, but for example in the case of Spanish legislation the application has to enclose a certificate of the municipality on the compatibility of the activity with the urban planning. This has been as well included for the case of new installations and substantial changes in the draft By-Law on IEPs transposing the IED requirements on integrated permitting in Turkey. What are the main difficulties that this requirement can cause?
- Relevant environmental aspects: Identify the aspects of the installation that can be relevant considering the process and the location and explain why they are important.
- Coordination of the IED and EIA (Environmental Impact Assessment) procedures. Most of the IPPC installations are under the scope of both Directives (Industrial emissions and Environmental Impact Assessment). There are several ways of administrative organization to comply with both of them. Do they need to be necessary separated administrative procedures? What information has to be provided in the EIA that is not applied for in the IEP? Are the existing installation treated in the same way as the new ones?

3.1.2.- 13:30 – 17:30

- Preparation of sections of the permit application: Air emissions section.

This part of the training will be focused on air emissions. Please check if all the information on air emissions is available in points 1 and 2, and try to solve the following questions:

- What are the main impacts on air caused by the refinery? Is the case study unit specially causing air emissions?
- Are enough parameters controlled online? What do you think about the system used? How to decide what are the air emission focus to be controlled and what parameters? How will you decide the % of compliance with the emission levels?
- What do you think about diffuse emissions? Is there any special situation to avoid or reduce these emissions?
- To understand the impact of the plant on noise pollution, which methodology would you ask to use to the operator to have a better characterization of the situation, modeling or spot (real) measurements? Why? What would be the reference standards required for modeling? What points you think are the biggest acoustic emitters in a refinery installation? Common mistakes in the noise information.

3.2.- Tuesday 7th of May

3.2.1.- 09:30 – 12:30

- Preparation of sections of the permit application: waste management.
- Preparation of sections of the permit application: wastewater discharges.

This part of the training will be focused on waste and wastewater. Please check if all the information on these issues is available in points 1 and 2, and try to solve the following questions:

- Based on the documentation submitted by the company, identify the waste generated in each process. Check if it has been provided all the essential information about the generation, classification, labeling and storage of waste. Has the company identified all the implementing legislation and BREFs?
- Revise the given lists classifying correctly the waste. Identify possible undeclared wastes and classify them.
- Check if the company keeps a chronological record of the generated waste. Define how should be the chronological record. Check if the company has demonstrated that they have the procedure for the correct management of the generated waste. Check if the company applies the Reference Document on Best Available Techniques on Emissions from Storage (available in the IPPC website, in

http://www.csb.gov.tr/projeler/ippc/index.php?Sayfa=sayfa&Tur=webmenu&Id=9294).

- Specific regulation: During the permitting process, it has been detected a transformer with PCB. The transformer fluid contains 0,015 % by weight of PCBs. Determine the obligations of the company about this transformer.

3.2.2.- 13:30 – 17:30

- Preparation of sections of the permit application: soil & groundwater.
- Preparation of sections of the permit application: inspections & monitoring plan.

This part of the training will be focused on soil and groundwater and also on inspections & monitoring plan. Please check if all the information on these issues is available in points 1 and 2, and try to solve the following questions:

- Do you think that the information provided is enough to fulfill the permit application?
- As you have seen in the information, the refinery has some problems with soil and groundwater pollution, please review if some more actions must be taken and discuss if there is a need to include all the data about that situation.
- About the inspection and monitoring plan, is any additional information needed? Notice the difference between the internal inspection and monitoring and the monitoring and inspection plan that will be done by the competent authorities. Do you think that once the refinery gets the permit internal monitoring will not be necessary anymore? Discuss why some parameters must be controlled by the refinery even though there is also a control by the competent authorities.

3.3.- Wednesday 8th of May

3.3.1.- 09:30 – 12:30

- Preparation of sections of the permit application: Annex on BATs.

This part of the training will be focused on refinery BATs implementation and other BATs that could be useful. Please check if all the information on these issues is available in points 1 and 2, and try to solve the following questions:

- Please notice the difference between the application of horizontal and vertical BREFs. Which horizontal BREFs do you think that could include some useful information or BATs applicable to the refinery?
- There is no special part of the documentation including the applied BAT but some of the actuations that are considered as BAT are described in points 1 and 2. Try to collect and order all the existing information about BAT.
- In addition, there are also some generally used techniques and behaviors in the refineries that are considered also BAT and not described in the information. List some

of these techniques and discuss if it is necessary to include a BAT chapter in the permit application.

3.3.- Wednesday 8th of May

3.3.1.- 13:30 – 17:30

- Presentation of the permit application completed by the Spanish experts and comparison with the sections prepared by the participants in the previous days.

This is the final part of the training and will be focused on checking the permit application prepared by the participants and comparing it with the general permit application template completed by the Spanish experts.

- Some final considerations must be taken into account to prepare a permit application for the whole refinery. Please consider that the situation of the refinery can be different in the moment of the permit presentation with respect to two or three years later, how could that fact affect the permit application?
- Remember that this example is only a small part of the refinery (although other parts have been explained as background information). But the permit application must include all the data for all the units in the refinery. Think about the best way of ordering the information and if there is a proper way to achieve a systematic approach that could be useful to avoid forgetting some information in the permit application.
- It is important to know that, the better your application is, the earlier you will obtain your permit. Notice that if any information is lacking, the authorities will ask for it, or even if the information is present in the permit application but not clearly explained.
- Please, feel free to comment or ask any question about the permit application.

Eşleştirme Projesi TR 08 IB EN 03
IPPC – Entegre Kirlilik Önleme ve Kontrol
T.C. Çevre ve Şehircilik Bakanlığı

PERMIT APPLICATION CONTENTS.

OIL REFINERIES.

BASIC PROJECT FOR THE REQUEST OF THE INTEGRATED ENVIRONMENTAL PERMIT OF THE FACILITIES OF :

LOCATED IN:

DATE OF ISSUE:

PREPARED BY[1] :	APPROVED BY[2] :
Name Signature	Name Signature

[1] Persons or company that have prepared the permit application

[2] Person who certifies the validity of this permit application on behalf of the company that owns the facilities for which the integrated environmental permit is requested.

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ANNEXES

- **Emission point sources. (referenced to labels)**
- **Diffuse emissions (referenced to labels).**
- **Rain water collection network (with intermediate storages, pumps, etc.)**
- **Points of Leak Detection and Repair (LDAR) Program.**
- **Air quality monitoring network.**
- **Points of waste storage and/or treatment.**
- **Site investigation of the Soil Monitoring Program.**

Annex I

Material safety data sheet (MSDS) and product safety data sheet (PSDS)

Annex II

Atmospheric Dispersion Model

- **Meteorological data.**
- **Emission sources with their heights and characteristics.**

Annex III

Air Quality Network.

- **Design of the Air Quality Network.**
- **Description of the Air Quality Network.**

Annex IV

Leak Detection and Repair (LDAR) program

Annex V:

Soil and Groundwater Monitoring Program

- **Site investigation / characterization of the existing contamination**
- **Stage 2: Monitoring**
- **Stage 3: Remediation**.

Annex VI:

Environmental Monitoring and Enforcement Plan

- **Assessment of ELVs compliance.**
- **Samplings and inspection frequencies.**
- **Frequency and systems to report to the Environmental Competent Authority.**

Annex VII:

Summary of BATs for processing units.

- **Applied BATs**
- **Planned BATs (with their expected implementation schedule)**

IMPORTANT PRELIMINARY EXPLANATIONS TO UNDERSTAND AND COMPLETE THIS DOCUMENT:

1.- You must complete not only the tables provided but also you must answer to all the information requests listed throughout this document.

2.- When permits or other documents requested are already included in the EIA report, you can make reference to the sections within the EIA where the requested permits or other documents can be found.

3.- In the case that the permit application is for a substantial change, the information mentioned above in point 1 must be provided, including as well the combined effects of both existing and projected units. In this case, the applicant should specify the information, concerning existing units, which was, in its moment, presented to the authority to obtain a permit for those existing units.

4.- In the case that the installation is an existing installation which until now has had a non integrated permit, but now needs to obtain an integrated environmental permit, the applicant should specify the information, concerning the existing facilites, which was, in its moment, presented to the Competent Authority to obtain their previous (non integrated) permit.

NON-TECHNICAL SUMMARY

Non-technical summary of the details specified in the rest of the permit application, to enable its comprehension in the public information period. Concerning this report the size should not exceed 20 pages.

The summary should identify all environmental issues of significance associated with the carrying on of the activity, and describe mitigation measures proposed or existing to fulfill all the current applicable environmental legislation.

The following information must be included in the non-technical summary:

A description of:

- the installation and its activities.
- the raw and auxiliary materials, other substances and the energy used in or generated by the installation,
- surroundings of the site (environmentally relevant aspects): surface waters, sea waters, flora, fauna, nature protected areas, populated areas, infrastructures (roads, railways...) and industries in the vicinity.
- environmental management systems implemented in the installation.
- interaction of the installation with its environment:

- Air emissions
- Air quality
- Wastewater discharges
- Water quality of the water bodies receiving the wastewater discharges
- Noise emissions
- Hazardous substances used
- Soil

– Emissions' monitoring and control plan

Include as well a yes/no answer to the following questions:

(a) all the appropriate preventive measures are taken against pollution, in particular through application of the Best Available Techniques (BAT);
(b) no significant pollution is caused;
(c) waste production is avoided in accordance with Council Directive 75/442/EEC of 15 July 1975 on waste; where waste is produced, it is recovered or, where that is technically and economically impossible, it is disposed of while avoiding or reducing any impact on the environment;
(d) energy and other resources are used efficiently;
(e) the necessary measures taken to prevent accidents and limit their consequences;
(f) the necessary measures are taken upon definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state.

PROJECT REPORT

The project report shall include, at least, the following basic elements related to the installation:

1. General data:

- Name of the company, trade name, VAT number, full address (including location, province, town, region and country), telephone, fax, e-mail.
- Owner of the installation, operator, legal representative, person in charge of the plant or production (if applicable), person in charge of environmental issues (if applicable) and contact person with his/her corresponding data (full name, position in the company, address, telephone and e-mail).

COMPANY
Trade name
Head office

ZIP code	City VAT	
Province		Telephone
Fax		E-mail
INSTALLATION		
Name		
Adress		ZIP code
City		Province
Telephone		E-mail
Person of contact		

2. Description of the installation:

2.1. Number of work centres, plants, delegations, headquarters, corporate address... The data of the contact person, position, address, telephone, fax and e-mail should be included for each of the centres.

2.2. Register number of the Ministry of Industry.

2.3. National Classification of Economic Activities (NACE).

2.4. Total number of workers.

2.5. Investments targeted to environmental improvements.

2.6. Organization chart (hierarchic representation of the staff with their corresponding positions or jobs).

2.7. Location: The UTM coordinates should be included, attaching a location map.

2.8. Local and/or regional information on the urban planning, soil uses and conditions (topographical, morphological, geological conditions ...), soil classification (urban land, non-urban area, rural land, and industrial and special soils ...) and weather conditions.

2.9. Main activities and others

2.10. Description of the environmental status of the site where the installation will be located and any impacts that may be foreseen, including any that may arise upon definitive cessation of the activities at the installation(for installations subject to EIA, this information is included in the EIA report).

As part of the information requested above these tables should be completed:

CHARACTERIZATION OF WORKING REGIME				
Number of staff	Permanent			
	Temporal			
Working hours	Hours/year[3]			
Date of the start of the activity of the facilities				
Date of commissioning of the Facility				
Coordinates UTM	X:	Y:	UTM zone[4]:	
Geographical coordinates	Latitude:	Length:		
Extension of the Facility [m^2]				
Neighboring settlement areas				
Watercourses affected*				
Nearby infrastructure*				
Environmental elements affected*	*Nature reserve, zone of hunt, endemic flora*			

*Location and distance with respect to the installation

Note:Attach a site plan for 1:5000 mapping

CATEGORY OF ACTIVITIES AND FACILITIES	
Main category of activity /Facility	Heading annex 1 of IEP By-Law
Other categories activity/Facility	Heading annex 1 of IEP By-Law
NACE (National Classification of Economic Activities) code:	

[3] When the installation has several power generation units, it will be considered as working hours those when at least one of those power generation units is working.

[4] UTM Zone: Turkey is between the zones 35 and 38.

Investments in the last 4 years targeted to environmental improvements(only for existing installations)

Information on the Urban planning

For new installations, or for existing installations that want to make a substantial change, the facility shall provide an urban compatibility report issued by the corresponding Competent Authority.

Information should be provided about the site of the installation: if it is an industrial area, if the soil is an industrial urban one or not (it could be an undeveloped land or a protected soil) and if that zone has the necessary equipments developed or not (like a sewage network, street lighting…)

Organization chart (hierarchical representation of the staff with their corresponding positions or jobs).

Note : attach chart

Environmental status of the site where the instalation is located.

Here the goal is to know if the installation is located in a zone or close to a zone with some special environmental value, for example near a nature reserve.

Environmental impacts.

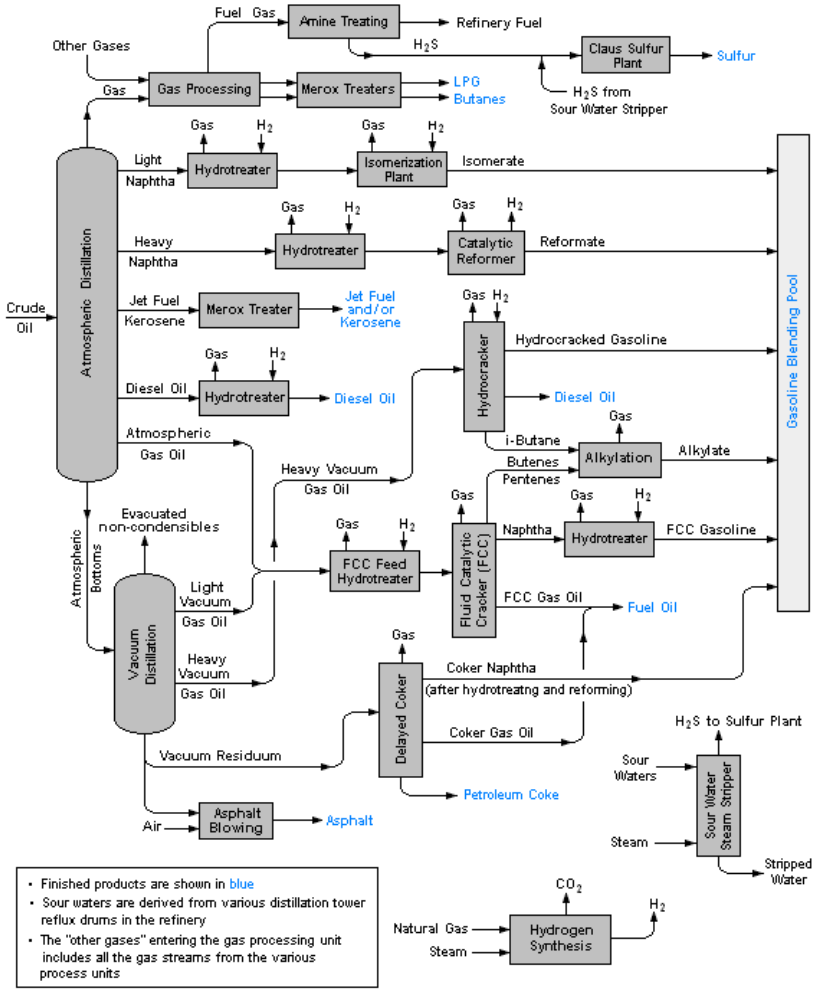
For existing installations, a brief summary about environmental status and impacts.
For new installations or substantial changes, they submit the EIA report.

3. Technical characteristics:

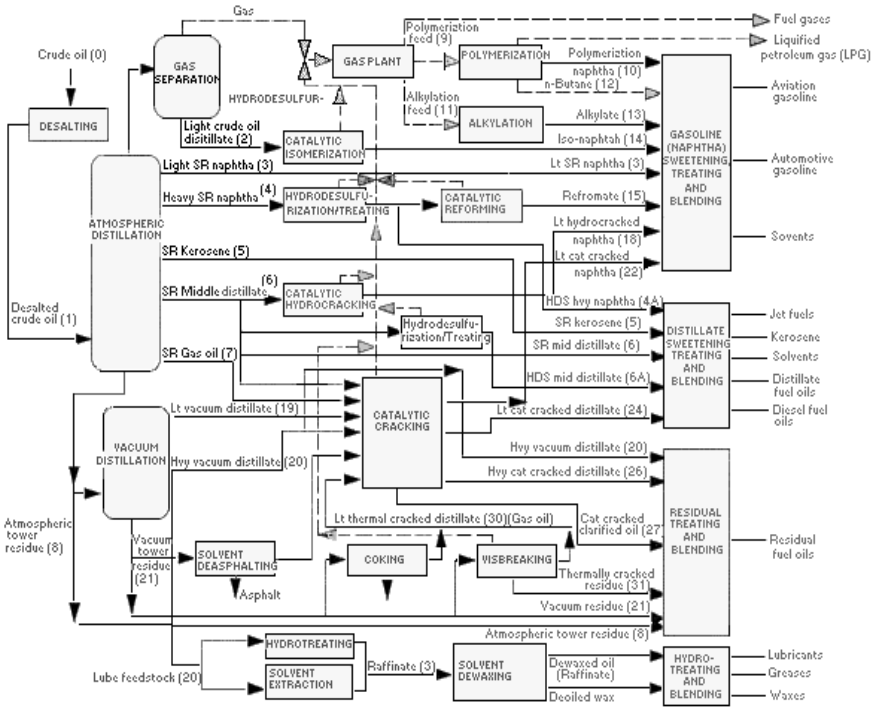
1. Processed Crude Oil
2. Refining Production
3. Storage capacity
   - Crude Oil
   - Final products

Flow chart

Example 1 of flow chart:



Example 2 of flow chart:



PROCESSES (units) IN THE REFINERY.

The permit application will focus on the units present in the refinery, selecting and numbering them.

Units can be for example selected and numbered according to the description of the next table and placed into the map of the refinery (the map will be included in Annex 0)

Process name	Existing (Yes/No) Unit Number with its Labels	Method	Purpose	Feedstock(s)	Product(s)
FRACTIONING PROCESSES					
Atmospheric distillation		Thermal	Separate fractions	Desalted crude oil	Gas, gas oil, distillate, residue
Vacuum distillation		Thermal	Separate w/o cracking	Atmospheric tower residue	Gas oil, lube stock, residue

CONVERSION PROCESSES--DECOMPOSITION					
Catalytic cracking		Catalytic	Upgrade gasoline	Gas oil, coke distillate	Gasoline, petrochemical feedstock
Coking		Thermal	Convert vacuum residues	Gas oil, coke distillate	Gasoline, petrochemical feedstock
Hydro-cracking		Catalytic	Convert to lighter HCs	Gas oil, cracked oil, residue	Lighter, higher-quality products
Hydrogen steam reforming		Thermal/ catalytic	Produce hydrogen	Desulfurized gas, O_2, steam	Hydrogen, CO, CO_2
Steam cracking		Thermal	Crack large molecules	Atm tower hvy fuel/ distillate	Cracked naphtha, coke, residue
Visbreaking		Thermal	reduce viscosity	Atmospheric tower residue	Distillate, tar
CONVERSION PROCESSES--UNIFICATION					
Alkylation		Catalytic	Unite olefins & isoparaffins	Tower isobutane/ cracker olefin	Iso-octane (alkylate)
Grease compounding		Thermal	Combine soaps & oils	Lube oil, fatty acid, alky metal	Lubricating grease
Polymerizing		Catalytic	Unite 2 or more olefins	Cracker olefins	High-octane naphtha, petrochemical stocks
CONVERSION PROCESSES--ALTERATION OR REARRANGEMENT					
Catalytic reforming		Catalytic	Upgrade low-octane naphtha	Coker/ hydro-cracker naphtha	High oct. Reformate/ aromatic
Isomerization		Catalytic	Convert straight chain to branch	Butane, pentane, hexane	Isobutane/ pentane/ hexane
TREATMENT PROCESSES					
Amine treating		Absorption	Remove acidic contaminants	Sour gas, HCs w/CO_2 & H_2S	Acid free gases & liquid HCs
Desalting		Absorption	Remove contaminants	Crude oil	Desalted crude oil
Drying & sweetening		Abspt/ therm	Remove H_2O & sulfur cmpds	Liq Hcs, LPG, alky feedstk	Sweet & dry hydrocarbons
Furfural extraction		Absorption	Upgrade mid distillate & lubes	Cycle oils & lube feed-stocks	High quality diesel & lube oil
Hydrodesulfurization		Catalytic	Remove sulfur,	High-sulfur residue/ gas oil	Desulfurized olefins

			contaminants		
Hydrotreating		Catalytic	Remove impurities, saturate HCs	Residues, cracked HCs	Cracker feed, distillate, lube
Phenol extraction		Abspt/ therm	Improve visc. index, color	Lube oil base stocks	High quality lube oils
Solvent deasphalting		Absorption	Remove asphalt	Vac. tower residue, propane	Heavy lube oil, asphalt
Solvent dewaxing		Cool/ filter	Remove wax from lube stocks	Vac. tower lube oils	Dewaxed lube basestock
Solvent extraction		Abspt/ precip.	Separate unsat. oils	Gas oil, reformate, distillate	High-octane gasoline
Sweetening		Catalytic	Remv H_2S, convert mercaptan	Untreated distillate/gasoline	High-quality distillate/gasoline
… Other units					

4. **Summary of the production process (units)**.

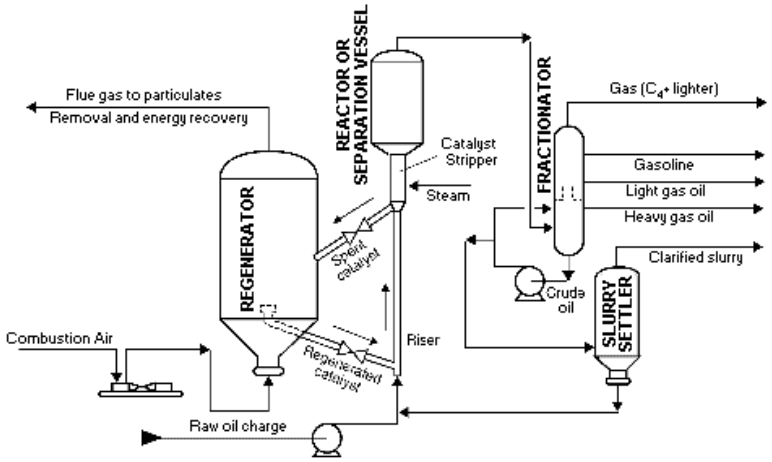
Include a detailed map of refinery specifying the position of each unit. The units must be positioned using their labels (the map shall be included in Annex 0).

For each of these units (selected from the table above) the following information must be provided:

- A description of the unit.
- Label and position in the map of refinery
- Raw materials
- Products.
- Connexion with other units
- The techniques used and specifying which of them are considered as Best Available Techniques (BATs)[5]. Just list them here, and then give more detailed explanations about them in Annex VII.

[5] As defined in the BAT Conclusion documents approved by the European Commission and, therefore, in the Turkish national BAT guide for oil refineries prepared within this IPPC Twinning project.

Example of the information to provide in Annex VII: FLUID CATALYTIC CRACKING: REGENERATOR OF THE CATALYST.



***BAT 9: Reduction of dust and metals emissions from the regenerator of the catalyst (catalytic cracking process) (Table 4.1 BAT-AELs** for dust and metals emissions from the catalytic cracking process)*

1. Primary or process related techniques applied:

Technique	Description	Applied Yes/no[6]
1 Use of an attrition-resistant catalyst	Selection of catalyst substance which is able to resist abrasion and fragmentation in order to reduce dust emissions	
2 Hydrotreatment of feed	Based on hydrogenation reactions, hydrotreatment aims at reducing sulphur, nitrogen and metal content of the feed when upgrading the refinery fractions for compliance with products specifications	

2. Secondary or end of pipe techniques applied:

Technique	Description	Applied Yes/no[7]
ectrostatic precipitator (ESP)	See technique a)	
ultistage cyclone separator	See technique c)	
ird stage blowback filter	See technique e)	
bric filter	See technique b)	
et scrubbing	Gaseous compounds are dissolved in a suitable liquid Simultaneous removal of solid and gaseous compounds may be achieved (REF BREF, Section 4.5.10.2)	

5. Natural resources, raw and auxiliary materials and products:

- Natural resources:

[6] Write "yes" if the technique is already implemented, and "no" if the technique is planned to be implemented, but has not yet been implemented.

[7] Write "yes" if the technique is already implemented, and "no" if the technique is planned to be implemented, but has not yet been implemented.

a. energy: use of different kind of fuels for heat and steam generation and for transport inside the refinery not including use of crude oil for production.
b. water: quantity of water used in the process, intake of surface, ground and marine water – detailed description of intake, and indication of the cases of supply of water from outside or re-circulated

- Raw materials: list and quantities of raw materials, indicating hazardous or non-hazardous character with their safety data sheets (MSDS) (include them in Annex I)
- Auxiliary materials: list and quantities of auxiliary materials, indicating hazardous or non-hazardous character with their safety data sheets (MSDS) (include them in Annex I)
- Products and by products: list of output products types and quantity generated of each of them, per hour, day or year, or as expressed in the units indicated in the Annex I of the Integrated Environmental Permit By-Law with their safety data sheets (PSDS) (include them in Annex I)

In addition, as part of the information requested above these tables should be completed:

Annual consumption: crude oil

Year[8]	Annual amount (MT)	% sulphur (average)
A		
A-1		
A-2		
A-3		

Annual consumption: water and electricity

Year[9]	Water Annual amount (m^3)	Electricity (selfconsumption) (MWh)
A		
A-1		
A-2		
A-3		

Electricity generated: (cogeneration units)

Year[10]	**Electricity generated(MWhb)**

[8] The applicant should provide data of the last 4 years (for existing installations) or estimates for the next 3 years (new installations)

[9] The applicant should provide data of the last 4 years (for existing installations) or estimates for the next 3 years (new installations)

A	
A-1	
A-2	
A-3	

Auxiliary materials and other products consumed (average)

Auxiliary material or product consumed	
Annual amount(t)	
MSDS in Annex I[11]	
Unit/s process	

Notes:
- The applicant should cover as many tables or columns as auxiliary materials are involved in the process.
- The figures provided should be representative (for existing installations), or for the new installations estimates made based on the design of the installation.

Products / Byproducts (amounts in Thousand Tonnes)

LPG	
KEROSENE	
GASOLINES	
NAPHTAS	
AGRICULTURAL DIESEL	
DIESEL	
FUEL OILS	
ASPHALTS	
BASE OILS	
SULPHUR	
OTHERS	

[10] The applicant should provide data of the last 4 years (for existing installations) or estimates for the next 3 years (new installations)

[11] Material Safety Data Sheet

6. Environmental emission and controls:

DISPERSION MODEL[12]

The application must include an atmospheric dispersion study, using mathematical models of dispersion of international recognition (include it as Annex II).

You must use a diffusion model incorporating meteorological stations in the area, atmospheric stability data (normally the classification used Pasquill-Gifford), height of the mixed layer (the atmosphere is uniformly mixed) and topographic relief.

Calculation of annual average hourly and daily exceedances and average every eight hours (as envisaged in the Directive on Ambient Air Quality and Cleaner Air for Europe 2008/50/EC) for NO_2, NO_X, SO_2, PM_{10}, $PM_{2,5}$ and CO.

Provide in any case the monitoring results for air quality requested in the current applicable legislation.

The dispersion model must be included into the Annex II, in order to facilitate its study by the Competent Authority.
It shall include the meteorological data as well as a map with the location of emission sources, indicating their heights and main characteristics (include the meteorological data and the map in Annex 0).

AIR QUALITY CONTROL NETWORK

If the authority does not have, in the refinery surroundings, enough information from its own air quality network about the air quality levels, the applicant must design an air quality monitoring programme.

In this case, the air quality monitoring programme design will depend upon the monitoring objectives specified for the air quality management in the selected area of interest: the influence area of the refinery.

The design of the Air Quality Network must be based on an air quality assessment providing ground level air quality monitoring data in the neighbourhoods surrounding the Refinery. In this initial study the neighbourhoods of particular interest must be identified[13].

In Annex III it must be included the design of the network, according to these goals and the results of the dispersion model, including a geographical map (Annex 0) of the surrounding area showing the industry position regarding nearest inhabited places, indicating the number

[12] In order to fulfill the requirements of Art. 30.1. of the Industrial Emissions Directive 2010/75/EU

[13] See section 5.1.2 of the BAT Guide for oil refineries

of inhabitants in each town/village. This map should also outline forested areas or existing crops, along with their characteristics.

6.1. Atmospheric emissions:

6.1.1. Channelled emissions:

- Description of emissions points: for the emissions produced in each unit, specify the destination. In particular, indicate whether:
  - It is piped directly to the atmosphere (in this case indicate the number characterizing the emission point).
  - It is sent to successive units.
- Requirements and technical conditions of the focus: height to ground level, diameter, outlet horizontal / vertical.
- Gaseous effluents generated: characterize the emissions that originate, specifying them qualitatively and quantitatively. The description should at least provide the following data:
  - Pollutants emitted indicating mass flow [kg / h] and concentration [mg / m^3].
  - Air flow [m^3 / h to 0ºC and 0,101MPa and % O_2].
  - Temperature.
- Abatement equipment: techniques adopted for the treatment of emissions originated in each stage.
- Position, into the map of Annex 0, of each stack point, specifying their label codes.

As part of the information requested above this table should be completed:

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Emission point			Flow (Nm^3/h)	Hours of Emission / day	T (ºC)	O_2(%)	Pollutants			Emission point height above ground (m)	Diameter or side section (m or m^2)	Abatement system[14]	Source of the data / Observations[15]
No	Unit label[16]	Description					Pollutant	Concentration (monthly average) (mg/Nm^3)	Mass flow (kg/h)				

Comentario [Cesar1]: Footnote giving the 3 possibilities (measured, estechiometry...)

[14] For example: C= Cyclone; F.T.= Fabric filter ; P.E.= Electrostatic precipitator; A.U.V.= Venturi wet scrubber; A.S.= Absorber; A.D.= Adsorber; P.T.= Thermal post-combustion; P.C Catalytic post-combustion; Others= specify.

[15] It should be included the kind of data: M-monitored, C-calculated, E-estimated

[16] Every emission point must be referencied to the label of its unit and placed in the map of Annex 0

- Plan for Monitoring and Control: It will contain the following data: Emission point, pollutant, sampling, control and data collection, transmission and registration system. The plan may be in any case subject to the modifications considered relevant by the Competent Authority.

As part of the information requested above this table should be completed:

Emission point (number and unit label)	Pollutant	Monitoring and Control			
		Internal/ External[17]	Frequency (continuous, daily…)	Description of sampling method	Reports

BLOWING OPERATIONS

If necessary, when the blowing operations to clean pipes are frequent because of the use in some units of heavy and solid fuels, the applicant must take into account their impact and possible measures to minimise it.

In these cases, it must be included a programme of blowing operations, that specifies the units, frequency and average duration of these operations.

[17] Here by "internal" it is meant that the monitoring and control is done by the operator of the installation, and "external" means that this task is performed by an external company.

The following aspects must be taken into consideration for the implementation of the programme:

- Adapt the number of blowings to the conditions of the ovens.
- Blow preferably overnight, to reduce the visual impact.
- For stacks with opacimeter:
    - In stacks associated to more than one oven, sequencing of the blowing.
    - Programme the start and end time of blowing, for a given stack, in the same civil hour, in order to avoid a delay in more than one hour average caused by the blowing.

In addition, indicate in the book of registries not only the blowings, but others events such as repairs of blowers, to help in the validation of the emission data.

The blowing programme can be reported using the next format:

STACK (number and unit label)	**STACK DESCRIPTION**	**ESTIMATED DURATION**	**HOURS**	**EQUIPMENT**	**ANALYZER**
(i.e.) 1-UV1 (stack 1 of vacuum unit 1)	Vacuum -1	45 min.	02:05-02:50	Ovens 12 y 13	Opacimeter
…					
…					
…					

6.1.2. Non channelled emissions (fugitive emissions):

- Description of the sources of fugitive emissions and identification of the substances that may be present in such emissions must be provided, mentioning as well as the existence of nearby villages.

  As part of the information requested above this table must be completed:

Emission source (storage area,...)			Pollutant
No.	Unit Label	Description	

- Estimation or calculation of fugitive emissions arising from the installation, expressed as a mass flow for each pollutant, describing the procedure of estimation / calculation used to obtain the quantities. If the estimate is made from real measurements, the relevant certificate and an analytical plan in which sampling points are defined must be attached.
- This emission points must be placed in the map of Annex 0.
- Note : International EFs (emission factors) are available.

VOC emissions

Annex IV must contain the Leak Detection and Repair (LDAR) program; based on the indications provided in Chapter 5 of the BAT Guide for oil refineries.

The basic contents of the LDAR[18] are the following ones:

a) Identifying Components
b) Leak Definition
c) Monitoring Components
d) Repairing Components
e) Record keeping

Using the standards EN 15446[19] and EPA21[20].

The points monitored must be placed in the map (Annex 0)

On the other hand, the applicant must include a monitoring programme for VOCs Additionally to the LDAR Programme, the applicant must include a monitoring programme for the odours and VOCs in the perimeter of the refinery.

The basic scope of the periodical odour-VOCs monitoring programme can be as follows:

Select a representative number of points in the perimeter of the refinery (between 5 and 10).

The methodology must be based in the use of diffusive samplers. *(i.e. bags, canisters, tubes, badges)*

Carry out measurements of concentrations of VOCs in this perimeter, through samplings of 24 hours, to be held weekly

- For these measurements of VOCs the analysis and sampling methodology to be used is established in the EN-13528-2[21] and EN-13528-3[22] standards, and for BTEX in addition to the above two, to the EN-14662-5[23] standard.

[18] **It is necessary to remember that the scope of a LDAR programme is, typically, from 20.000 to 40.000 monitoring points. (i.e. Puertollano-Spain refinery implemented its LDAR with over 25.000 points) (the cost was approximately 100.000 € per year)**

[19] **EN 15446:2008 'Fugitive and diffuse emissions of common concern to industry sectors - Measurement of fugitive emission of vapours generating from equipment and piping leaks'**

[20] **EPA METHOD 21 "Determination of volatile organic compound leaks"**

[21] **EN-13528-2 Ambient air quality. Diffusive samplers for the determination of concentrations of gases and vapours. Requirements and test methods. Specific requirements and test methods**

Odour control

Include an odour monitoring programme. *The basic scope of the periodical odour monitoring programme can be as follows*:

Comentario [Cesar2]: Check if this is compatible with Turkish legislation.

- Select a representative number of points in the perimeter of the refinery (between 5 and 10).

Odour control can be based on the EN 13725 Standard "Determination of odour concentration by dynamic olfactometry" which defines the European standard defining olfactometry measurement methods or, alternatively, using a nasal organoleptic instrument, that directly measures and quantifies odour strength in the ambient air using the operating principle of mixing odourous ambient air with odour-free filtered air in discrete volume ratios. (see Chapter 5 of the BAT Guide for oil refineries)

Alternatively, the measurements will be based on current legislation on odours.

6.2. **Noise emissions to the surroundings of the installation**:

In case that the installation is exempt of noise controls according to the applicable noise legislation, the operator will only have to provide the document proving that it has such exemption.

- Include a description of the main sources:

- Description of noise sources in the refinery, their locations and heights. It will include the indication of the data related to acoustic power of the different noise sources or, if not available, sound pressure levels, presence of an impulsive and tonal component, and, if necessary, the directionality of each source. In situations of uncertainty on project type or location of sound sources that will be installed, emission levels should be estimated by analogy with those from similar sources.

As part of the information requested above this table should be completed, considering particularly the flares:

[22] **EN-13528-3 Ambient air quality. Diffusive samplers for the determination of concentrations of gases and vapours. Requirements and test methods. Guide to selection, use and maintenance**

[23] **EN 14662-5 Ambient air quality - Standard method for measurement of benzene concentrations - Part 5: Diffusive sampling followed by solvent desorption and gas chromatography**

Unit (label)	Identification of noise sources	Description	Location	Height	Frequency	Sound Power or Sound Pressure

- Identification and description of receivers (eg hospitals, schools, homes, parks, etc.) present in the surrounding area, with details of their relevant characteristics in terms of noise (eg intended use, height, distance from the installation or activities planned, etc.)[24].

6.3. Wastewater discharges:

The applicant will include, in the map of the refinery (Annex 0 of the application), the different waste water flows specifying, particularly, the rain waters collection network and, if they exist, its intermediate storage points.

- Description of the Waste Water Flows: A summary list of flows (including process, sanitary and rain waters), supporting documentation should be included. For each of the flows the following information should be provided:
  - Industrial wastewaters: details of all emission sources of industrial waste waters[25] and emissions points from them to the receiving medium (inland and sea surface water) or to the public sewage system with the industrial waste water (pre)treatment plant data should be provided.
  - Sanitary Waters: details of all emission sources of sanitary waste waters and emissions points from them to the sewage system with external or internal waste water treatment plant data should be provided.
  - Rainwater discharges: details of all emission sources of rainwater (rainwater drainage) and emissions points from them to the receiving media should be provided.
  - Discharges to sea: for installations discharging directly to the sea, they will have to complete the information requested in Annex of the su kirliliği kontrolü yönetmeliği idari usuller tebliği (Resmi Gazete Tarihi: 10.10.2009 Resmi Gazete Sayısı: 27372). They will have in any case to provide the information to check the compliance with MARPOL Convention requirements[26].

[24] The measurements shall fulfil the By-Law 25862, based in the Regulation of Assessment and Management of Environmental Noise (2002/49/EC). (see Chapter 5 of the Guide)

[25] In case of cooling systems (direct cooling, indirect cooling, open/close loops), description and supporting documentation (like the list of substances used in cooling waters in an existing installation, and heat discharge calculation sheets) should be also provided.

[26] Within the frame of the International Convention for the Prevention of Pollution from Ships (MARPOL) for prevention of pollution of the marine environment by ships from operational or accidental causes, the following information must be provided (specially applicable for MARPOL Annex I "hydrocarbon pollution"):

Description of the facilities of the refinery dedicated to the management of ship waste if any:

- Location in the map of the refinery.

- Identification, quantification, and chemical and physical characterization of all kinds of waste that could be treated.

- Water mass balance of the installation (amounts of water intakes and amounts discharged).

In addition, as part of the information requested above this table should be provided for existing discharges:

- Waste treatment capacity per year.

- Treatment techniques used and description of the techniques.

- Characterization and quantification of effluent.

Description of the wastewater generated in these facilities dedicated to the management of ship waste, providing the same information that is provided for general industrial wastewaters.

Eşleştirme Projesi TR 08 IB EN 03
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1. Data for the discharge					
Discharge name		code			
U.T.M. coordinates		X:		Y:	
Municipal/region name		code		Parcel No:	

2. Volume flow, amount and type of waste water for particular stream which is conducted on that discharge				
Kind of stream: industrial, sanitary and rainwater on that discharge				
Stream code	X1	X2	X3	X4
Waste water type (industrial, sanitary, rainwater)				
Max. amount per day (m^3/day)				
Max. annual amount (Hm^3/year)				
actual annual amount (m^3)				
Type of discharging:				
Total area collecting rainwater (m^2)				
Destination of the discharge after the treatment[27]				

[27] Please choose one: public sewage with WWTP (PSWWTP) ; inland surface water body (ISWB) ; other (O), in this last case please explain in detail.

- Requirements and technical conditions of the discharging points: Detailed description of the existing sampling points within the installation, for each of the wastewater flows. Besides, the following information about existing wastewater depuration systems shall be provided:
  - Industrial Waters: Detailed description of the industrial WWT plant or other depuration systems. For each industrial WWT plant the operational procedure should exist together with operational records. The operational procedures should include at least the following information:
    - WWT plant operator.
    - Information regarding substances which are used both in the industrial water lines which feed the WWTP, and during the different wastewater treatment stages.
    - Treatment techniques; Pollution reduction %.
    - Average emission value after (pre)treatment: Normal operation (Kg/tonnes product)/ Abnormal operation (start-up, etc).
    - WWT plant operational data (technology/process description, WWT plant efficiency).
    - Management of sludges (solid or liquid) after treatment.
    - Operational and maintenance procedure.
    - Procedure for the control together with monitoring system.
    - Corrective actions in case of accidents (incidents) together with start-ups and WWT plant interruptions.
    - Maintenance and preparation procedure of operational records.

As part of the information requested above this table should be completed:

WWT operator[28]	**Treatment techniques of the industrial WWT**[29]**:**			
	Substance/parameter	**Average emission levels after treatment at normal condition, mg/l**	**WWT efficiency**[30]**, %**	**Sludges (liq./sol.), kg**

WWT control status of monitoring system			
Continuous measurement		Discontinuous measurement (key parameters)	
pH		COD	
T		Heavy metals	

[28] It can be the same operator as the one of the installation that discharges the wastewaters, or a different one, for example it may be a different operator in Organised Industrial Zones.

[29] Examples: mechanical treatment, chemical treatment, biological treatment.

[30] Specify the efficiency in % of reduction for: (i) COD if it is a physicochemical treatment, (ii) COD or BOD if it is a biological treatment, or Nitrogen if there is nitrification or denitrification.

Waterflow, m^3		other[31]	

- Sanitary Waters: detailed description of the sanitary WWT plant and all techniques for pollution prevention should be described.
- Rainwaters: description of all the buffer measures implemented to contain rainwaters.
- Other discharges: detailed description of the decentralised or centralised (on-site or off-site) treatment facilities or other depuration systems and all techniques for pollution prevention should be described.

▪ Plan for Monitoring and Control: It will contain the following data: Emission point, pollutants, sampling, control and data collection, transmission and registration system. The plan may be in any case subject to the modifications considered relevant by the Competent Authority.

As part of the information requested above this table should be completed:

Discharging point	Pollutant/s	Monitoring and Control				
		No.sample	Internal/ External[32]	Frequency (hourly, daily…)	Description	Reports

Indicate the water quality standards that should have the water bodies that receive the discharges of treated wastewater, according to the applicable legislation.

Indicate as well the physical chemical and biological parameters of the receiving water bodies of the effluent from the refinery (upstream and downstream of the discharge point).

ASSESSMENT STUDY OF TOXICITY, PERSISTENCE AND BIOACCUMULATION OF EFFLUENTS

The applicant must specify if there exists some of the following techniques[33] and their scope:

[31] Include at least all those which are established as compulsory for your kind of installation in the national legislation.

[32] Here by "internal" it is meant that the monitoring and control is done by the operator of the installation, and "external" means that this task is performed by an external company.

[33] See Chapter 5 of the Guide

1. Specific analyte measurement (e.g. Semi-Permeable Membrane Device (SPMD), caged mussels, large volume *in situ* sampling);
2. Other water and sediment quality parameters;
3. Tissue analysis using for example mussels and/or fish;
4. Solid phase extraction (SPE) techniques;
5. Biomarkers;
6. Dilution studies using dyes and other markers

6.4. **Waste:**

Waste production:

- Waste characterization: Detailed description of the activities (related to the production processes or to other activities not related to production processes) where the hazardous and non-hazardous wastes are generated. Information related to classification, labelling and storage of waste shoulds be provided.

- Storage conditions: Description of key features of storage (area, height, type of floor, presence of isolating covers, spill prevention devices).

As part of the information requested above this kind of table should be completed:

Example of table:

Process or Unit Label	Waste description	EWR Code	Production (T/month or year)	Destination
Maintenence operations	Absorbents, filter materials (including the oil filters otherwise specified) wiping cloths, protective clothing contaminated by dangerous substances	15 02 02	---- /month ----/year	Landfill
	Volatile oily fly ash and dust from boiler	10 01 04	---- /month ----/year	
	Packages containing dangerous substances or contaminated by those	15 01 10	---- /month ----/year	Inertization

Process or Unit Label	Waste description	EWR Code	Production (T/month or year)	Destination
	Other solvents and solvent mixes	14 06 03	---- /month ----/year	Recovery
	Aqueous washing liquids	12 03 01		
…	…	…	…	

Waste management:

- Offsite transfer to authorised waste operators: identification of the transfer and shipment notification of hazardous and non-hazardous wastes should be provided.

- In-site treatment of waste: describe in detail treatment given to each waste, quantities treated. Include a detailed map (to be included in Annex 0 of this permit application) showing the areas related to the treatment given to each type of waste. Measures to mitigate the risks to human health and the environment when handling the waste should be provided.

  - Admission procedure for wastes: description of the procedure for admission of wastes should be provided including the way that the operator implements the following aspects[34]:

    1. Check of the documentation (approval of the vehicle, monitoring and control document fill-in...).
    2. Weight and register of the load (weighing, date and time of arrival, waste origin, type of waste, waste vessel...).
    3. Visual inspection.
    4. Characterization and / or periodic sampling of the waste.
    5. Notification to the Competent Authority in the absence of waste acceptance.

  - Treatment operations: description of the treatment operations including the following aspect:

    1. A flow chart of treatment operations.
    2. The techniques[35][36] used for the treatment operations.

Comentario [Cesar3]: Change after we receive Turkish feedback on this

[34] Include the reports which have to be sent to the Competent Authority according to current Turkish legislation on waste management.

[35] A comparison of the techniques used with respect to the BATs included in the BAT Conclusion documents approved by the European Commission should be provided.

3. The quantity of materials recovered.
4. Any energy recovery (mode, use, quantity).
5. Nominal capacity of the system (kg / h).
6. Current capacity of the system (kg / h).
7. Number of daily hours of operation.
8. Number of days in a year.

- Technical requirements for disposal: describe in a detailed manner the activities that will be carried out for the final disposal of the rejected materials resulting from the treatment operations.

- Plan for the minimization of waste: A detailed description of the plan prepared to minimize[37] packaging waste generated in production processes. The plan may be in any case subject to the modifications considered relevant by the Competent Authority.

6.5 Soil and groundwater protection:

MONITORING PROGRAM

A monitoring programme will be included as Annex V of the permit application, divided into the following stages:

- Stage 1: Site investigation / characterization of the existing contamination;
- Stage 2: Monitoring;
- Stage 3: Remediation.

The contents of this program shall follow the indications about LDAR included in Chapter 5 of the BAT Guide for oil refineries.

6.6. Operation under not normal conditions:

- Description of the operation modes different from the normal operation (start-up and shut-down operations, leaks, malfunctions, momentary stoppages, definitive cessation of operations, etc) and of the situations which cause them.
- Expected emissions under those circumstances (pollutants and concentrations).
- Expected percentage of operation under those circumstances (hours/year).
- Special measures planned to be followed under those circumstances and goals to be achieved by taking those measures.

[36] In any case, the description of these treatment techniques as well as the way they are implemented will have to comply with the relevant environmental legislation in force.

[37] Minimization means reducing the material amount of the packaging waste (quantitative prevention) and the harm that these materials can cause in the environment (qualitative prevention).

- Systems for the monitoring and control of parameters under those circumstances.
- Description of the operation under emergency situations.

ANNEXES TO THE PROJECT REPORT

These are the annexes which have been mentioned and described previously in sections

3-6. Annex 0

Maps of the refinery.

- **Units in the refinery. (labeled)**
- **Emission point sources. (referenced to labels)**
- **Diffuse emissions (referenced to labels).**
- **Rain water collection network (with intermediate storages, pumps, etc.)**
- **Points of Leak Detection and Repair (LDAR) Program.**
- **Air quality monitoring network.**
- **Points of waste storage and/or treatment.**
- **Site investigation of the Soil Monitoring Program.**

Annex I

Material safety data sheet (MSDS) and product safety data sheet (PSDS)

Annex II

Atmospheric Dispersion Model

- **Meteorological data.**
- **Emission sources with their heights and characteristics.**

Annex III

Air Quality Network.

- **Design of the Air Quality Network.**
- **Description of the Air Quality Network.**

Annex IV

Leak Detection and Repair (LDAR) program

Annex V:

Soil Monitoring Program

- Stage 1: Site investigation / characterization of the existing contamination
- Stage 2: Monitoring
- Stage 3: Remediation.

Annex VI:

Environmental Monitoring and Enforcement Plan

- **Assessment of ELVs compliance.**
- **Samplings and inspections frequencies.**
- **Frequency and systems to report to the Environmental Competent Authority.**

Note: guidance on the contents of this Annex can be found in Section 5.6 of the BAT Guide for oil refineries.

Annex VII:

Summary of BATs for processing units.

- **Applied Best Available Techniques (BATs)**[38]
- **Planned BATs (with their expected implementation schedule)**

[38] As defined in the BAT Conclusion documents approved by the European Commission and, therefore, in the Turkish national BAT guide for oil refineries prepared within this IPPC Twinning project.

OTHER DOCUMENTATION DIFFERENT FROM THE PROJECT REPORT

i. **Environmental Impact Assessment (EIA) Report according to the legislation on the environmental impact assessment to the Competent Authority and after its acceptance preparation of the EIA report and project presentation file**(if applicable to the installation, taking into account if it is a new or existing installation)**.** The report is the one mentioned in article 11 of the EIA By-Law 26939.

ii. **A report from the competent administration responsible of development plans and landscape planning in which the site for the installation is located, evidencing compatibility of the project with urban planning provisions.** If the applicant applied for such report to that competent administration and no report is provided within 40 working days, that report shall be replaced by the applicant with a copy of the application for the report. In any case, if the urban report is negative, the Competent Authority will bring the permit procedure to an end.

iii. **A report from the Competent Authority on control of major-accident hazards involving dangerous substances, classifying the activity according to the legislation.**

iv. **Identification of the information which the applicant deems to be confidential under the provisions in force.** When assessing this point, the applicant should take into account that the application will be submitted to public information during 15 working days, plus the legislation applicable.

v. **Any other documentation evidencing compliance with the requirements under the applicable environmental legislation on obligatory security or insurance**[39].

vi. **Any other documentation evidencing compliance with the requirements under the applicable environmental legislation.**

vii. **Any other documents required by the Competent Authority.**

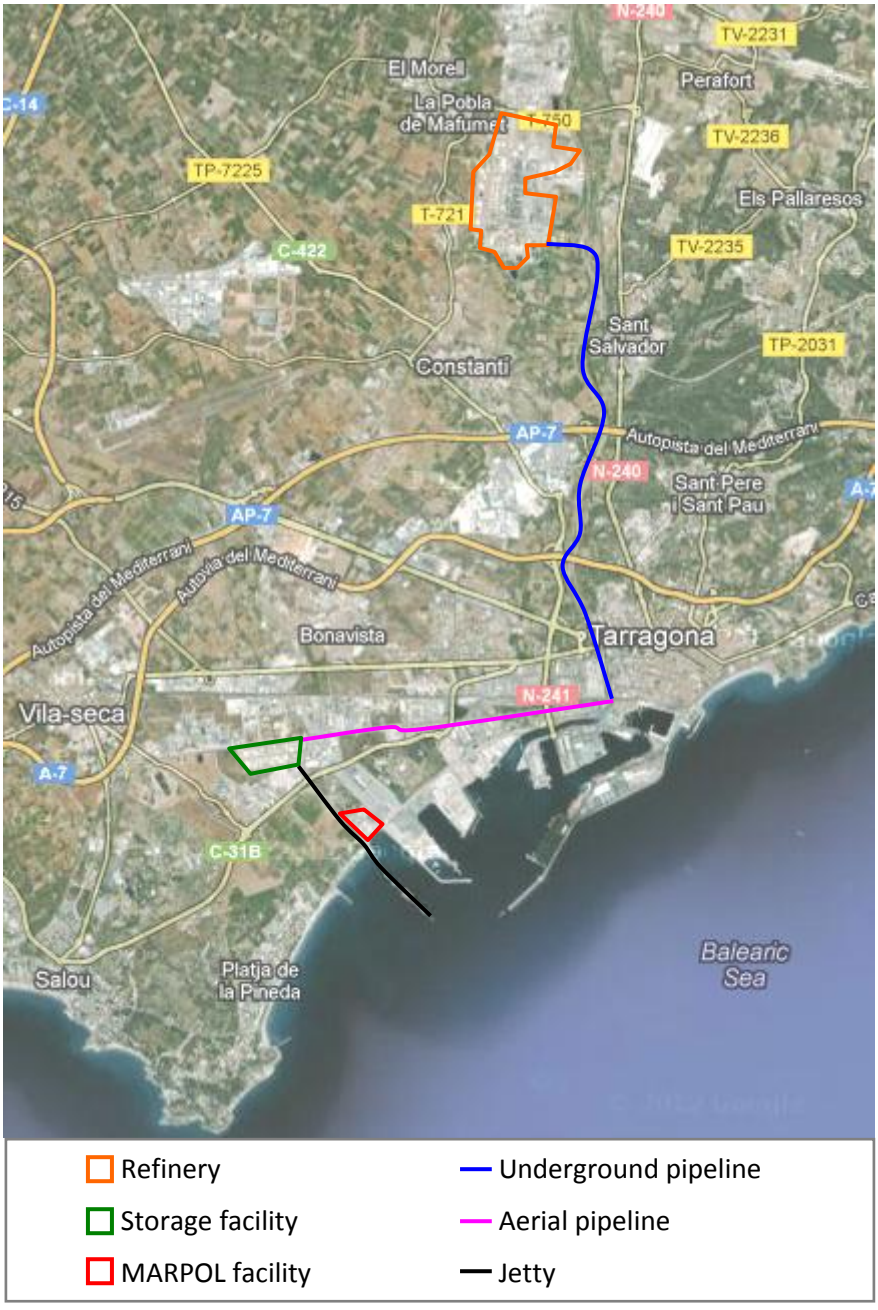
[39] We should take care that this part is compatible with the final version of the By-Law.

1.- INTRODUCTION

1.1.- General introduction to the refinery example

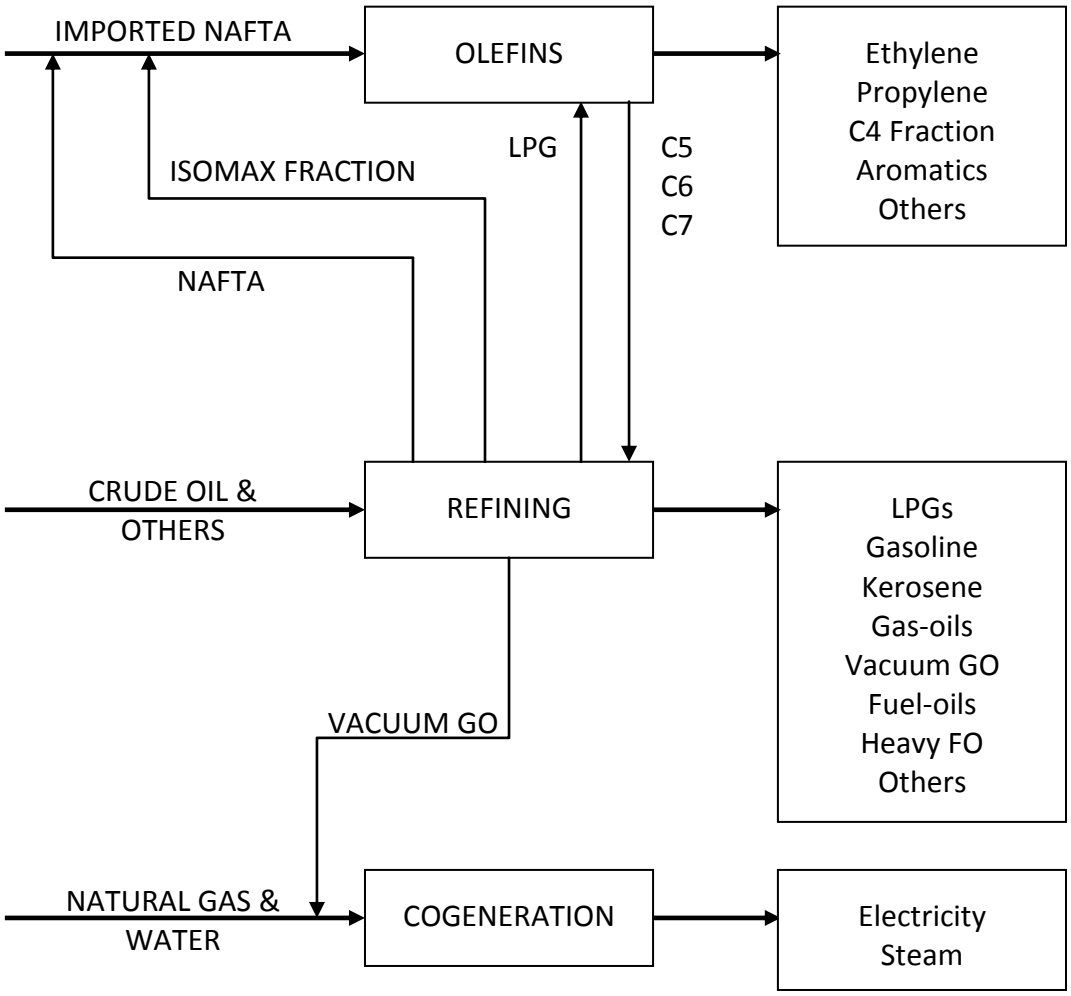
PLEASE, TAKE INTO ACCOUNT THAT SOME DATA HAS BEEN REMOVED OR MODIFIED DELIBERATELY FOR THIS EXERCISE.

First of all, let us explain the geographical situation of the refinery that is going to be used as example and the complementary installations:



The three installations (refinery, storage facility, MARPOL facility), and also other industrial facilities, use the pipeline to interchange products and integrate some processes so they operate as a whole. But we are going to focus our case study in the **refinery installation**.

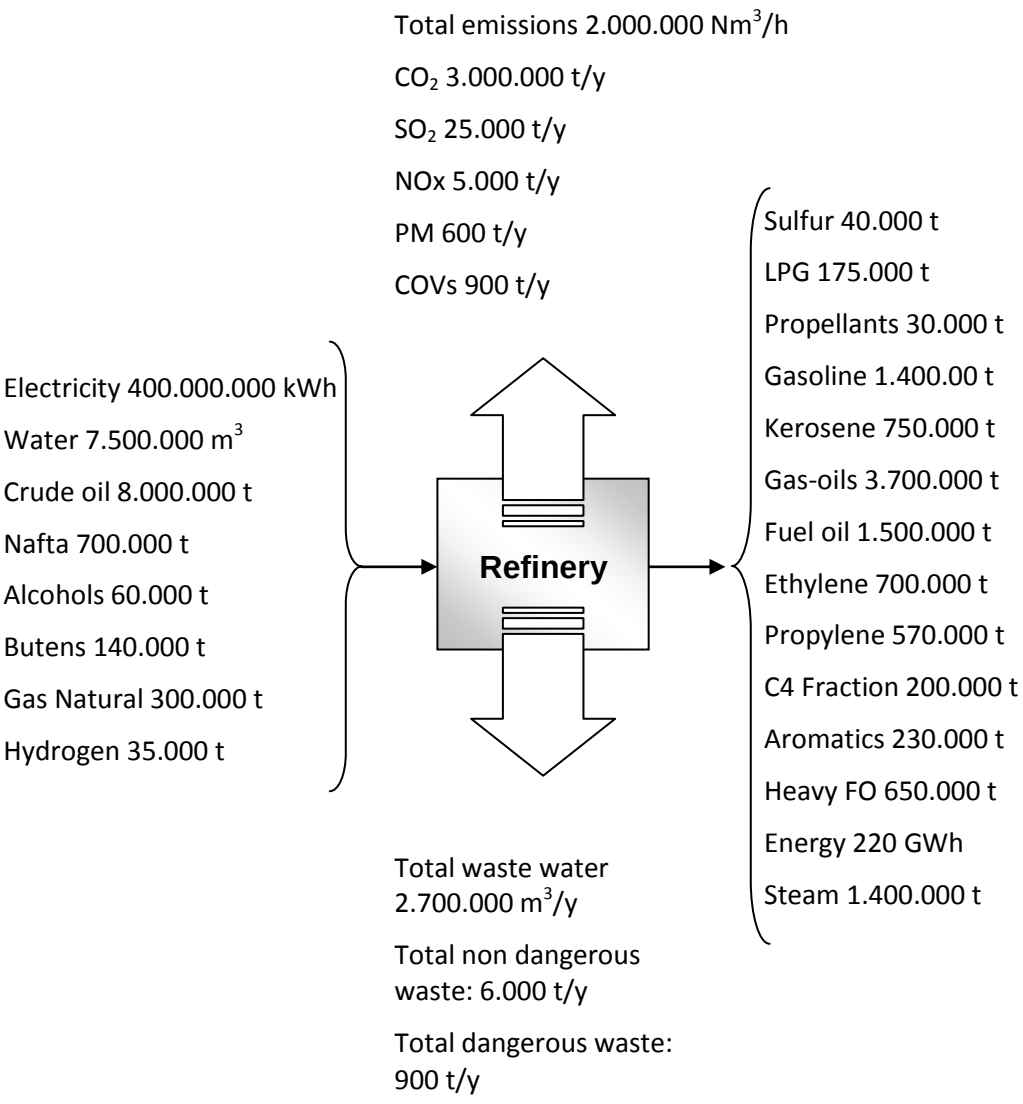
The refinery used as example has three main production plans: fuels plant, olefins plant and cogeneration plant. The general scheme is as follows:



The main final products obtained in these three plants are:

Kind of product	Product
Gaseous products	Hydrogen Methane Ethylene Propylene Butenes Fuel gas LPGs Propellants C4 fraction Isobutane Aromatics
Light products	Naftas Gasolines (95, 98, 97 OI and without lead)
Intermediate products	Kerosene Gasoils (cars, farming, domestic heating…)
Heavy products	Fuel-oils Petrochemical heavy fraction Heavy fuel-oil
Solid products	Sulfur
Other	Electricity

The approximate data about the whole refinery could be explained with the next chart:



1.2.- Choosing the case study unit

The fuels plant is characterized by the integration between the different units, by the complexity and by the capacity of obtaining light products from heavy ones.

It is important to explain that the different units are very homogeneous, not only from a technological point of view (using the same equipment: furnaces, reactors and distillation columns mainly) but also from the point of view of raw materials and obtained products (which are always crude-oil distillation products). This homogeneity means that all the units will have a similar environmental and security performance without very significant differences between them. This could be observed if we analyzed the different environmental vectors as a whole, for example:

- Air emissions are very similar in all the units, as the furnaces and fuels used are the same (fuel oil and fuel gas). The only variation is the amount of fuel used in each furnace dependant on their size. In fact, the emission of all waste gases are emitted through the same stack, and the emission controls are all made in this general stack.

- With waste water the situation is very similar. The pollutants are the same in all the units changing only the amounts of pollutant generated. The final destination for the waste water in each unit is the same, the general waste water treatment plant, where all the controls of flow and quality are made.

- In the case of solid waste the situation is also the same. None of the process units generates process waste. In fact, the waste generated in these units is associated directly to maintenance and cleaning operations. Therefore, the waste generation is not a continuous process but a periodic process with a frequency related to maintenance and cleaning process: cleaning (generating oily sludge, ashes and slag) and maintenance (refractory material from furnaces, scrap metal, general waste, wood, alumina, ion exchange resins, catalysts). There is no unit producing different waste or especial ones, even the catalysts waste are similar because the reactions are also very similar (hydrocracking and hydrodesulfurisations).

Taking into account what has been explained before, it makes no difference which unit is selected to use it as example, because all the units will have similar environmental and security aspects to be considered.

The units that we have chosen are the primary distillation units of crude oil, at the very beginning of the refining process. Desalting units are also included.

1.3.- General explanation of the unit according to the BAT guide for oil refineries prepared within the context of the Twinning IPPC (available in the IPPC website www.csb.gov.tr/projeler/ippc)

1.3.1.- Desalting unit

a) Purpose and principle

Crude oil and heavy residues can contain varying quantities of inorganic compounds such as water soluble salts, sand, silt, rust and other solids, together characterised as bottoms sediment. These impurities, specially salts, can lead to fouling and corrosion of heat exchangers (crude preheaters) and specially the crude distillation unit overhead system. In addition, salts are detrimental to the activity of many of the catalysts used in the downstream conversion processes and sodium salts stimulate coke formation (e.g. in furnaces). The principle of desalting is to wash the crude oil or heavy residues with water at high temperature and pressure to dissolve, separate and remove the salts and solids.

b) Feed and products streams

Crude oil and/or heavy residues (oily feedstock) and reused and fresh water are the feedstreams to the desalter, and washed crude oil and contaminated water are the outputs of the desalting processes. The water phase from the overhead crude distillation unit of the overhead and other used water streams are normally fed to the desalter as washwater.

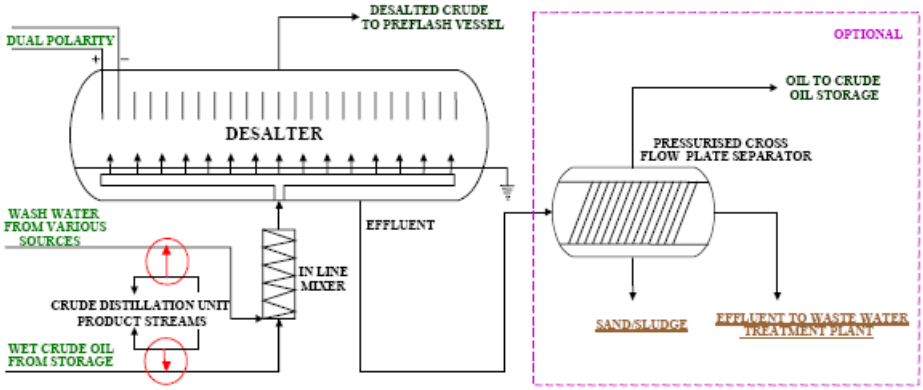
c) Process description

After preheating to 115 – 150 °C, the oily feedstock is mixed with water (fresh and preused water) in order to dissolve and wash out the salts. Intimate mixing takes place between the oil and the wash water together in a globe valve mixer, a static mixer or a combination of both. The water must then be separated from the oil feedstock in a separating vessel by adding demulsifier chemicals to assist in breaking up the emulsion and/or, more commonly, by applying a high potential electric field across the settling vessel to coalesce the polar salt water droplets. Either AC or DC fields may be used and potentials from 15 to 35 kV are used to promote coalescence.

The separation efficiency depends on pH, density and viscosity of the crude oil, as well as the volume of wash water used per volume of crude. Many refineries have more than one desalter and multiple-stage desalters also exist.

The washwater containing dissolved hydrocarbons, free oil, dissolved salts and suspended solids is further treated in an effluent treatment plant.

Where bottoms sediments are critical in downstream process units, desalters are equipped with a bottom flushing system to remove settled solids.



Simplified flow diagram of a crude desalter

1.3.2.- Primary distillation units

This section includes atmospheric and vacuum distillation. These two primary distillations are preceded by crude oil desalting and they are the first and fundamental separation processes in a refinery.

a) Purpose and principle

In Atmospheric Crude Oil Distillation Unit (CDU), crude oil is heated to elevated temperatures and then generally subjected to distillation under atmospheric pressure (or slightly higher) separating the various fractions according to their boiling range. Heavier fractions from the CDU bottom, which do not vaporise in this column, can be further separated later by vacuum distillation, which is simply the distillation of petroleum fractions at a very low pressure to increase volatilisation and separation whilst avoiding thermal cracking. The high vacuum unit (HVU) is normally the first processing step in upgrading atmospheric residue followed by downstream refining units. HVU produces feedstocks for cracking units, coking, bitumen and base oil units. The contaminants from the crude oil stay predominantly in the vacuum residue.

b) Feed and products streams

The crude oil feed to the crude distillation unit is supplied from the crude oil storage tanks after desalting. Normally all crude oil entering a refinery passes through a crude distillation unit. In addition to that, it is common practice that off-specification product streams are reprocessed in the CDU.

The products from the crude distillation unit, ranging from the lightest to the heaviest cut are:

- naphtha and light components (boiling <180 °C/C1-C12 lights, naphtha and gasoline)
- kerosene (boiling range 180 – 240°C – C8-C17)
- light gasoil (boiling range approximately 240 - 300 °C/C8-C25)
- heavy gasoil (boiling range approximately 300 – 360 °C/C20 - C25)
- atmospheric residue (boiling >360 °C/>C22).

The overhead of this column is the light fraction, non-condensable refinery fuel gas (mainly methane and ethane). Typically this gas also contains hydrogen sulphide and ammonia gases. The mixture of these gases is known as 'sour gas' or 'acid gas'. A certain amount of it passes through the condenser to a hot well, and is then discharged to the refinery sour fuel system or vented to a process heater, flare or other control device to destroy hydrogen sulphide.

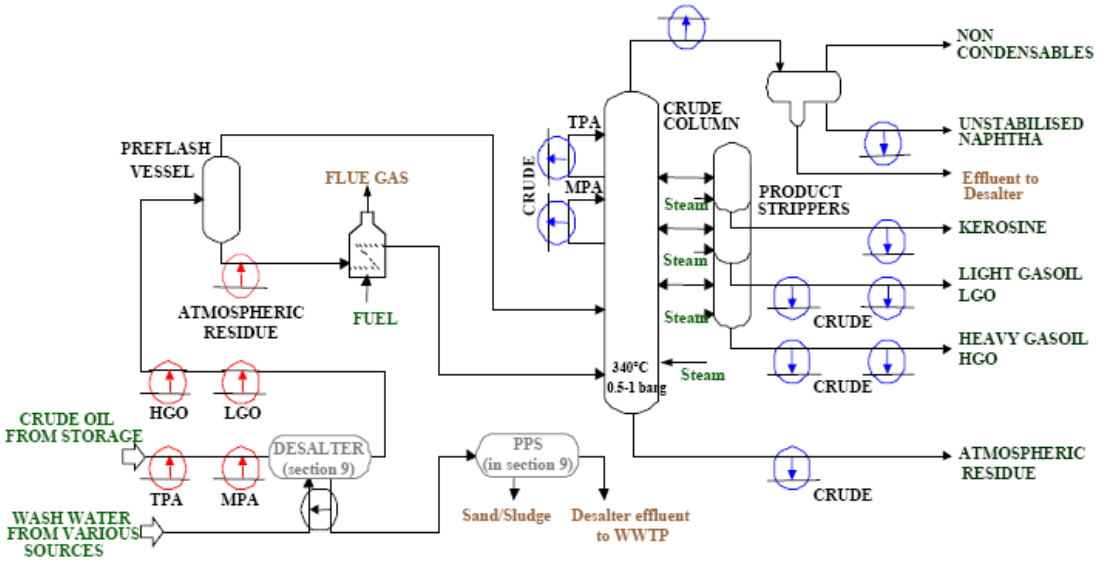
The main feed stream to the HVU is the bottom stream of the crude oil distillation unit, referred to as atmospheric or long residue. In addition the bleed stream from the hydrocracker unit (if applicable) is normally sent to the HVU for further processing. The products from the HVU are light vacuum gasoil, heavy vacuum gasoil and vacuum residue. Light vacuum gasoil is normally routed to the gasoil hydrotreater(s), heavy gasoil is normally routed to a fluid cat cracker and/or hydrocracker unit. The vacuum residue can have many destinations such as visbreaking, flexicoking or delayed coking, residue hydroprocessing, residue gasification, bitumen blowing or it may go to the heavy fuel oil pool.

c) Process description of Atmospheric distillation

Distillation involves the heating, vaporisation, fractioning, condensation, and cooling of feedstocks. The desalted crude oil is heated to about 300 – 400 ºC and fed to a vertical distillation column at atmospheric pressure where most of the feed is vaporised and separated into its various fractions by condensing on 30 to 50 fractioning trays, each corresponding to a different condensation temperature. The lighter fractions condense and are collected towards the top of the column. The overhead hydrocarbon vapours are condensed and accumulated in the overhead reflux drum of the main fractionator. In this drum sour water, light fractions (about 0.5 % on crude charge) and stripping steam (1.5 % on crude) are separated from the hydrocarbon liquid. The overhead hydrocarbon liquid, so called the naphtha minus stream, is commonly fed directly to the downstream naphtha treater.

Within each atmospheric distillation tower, a number of side-streams of low-boiling point components are removed from different trays in the tower. These low-boiling point mixtures are in equilibrium with heavier components which must be removed. The side-streams are each sent to a different small stripping tower containing four to ten trays with steam injection under the bottom tray. The steam strips the light-end components from the heavier components and both the steam and light-ends are fed back to the atmospheric distillation tower above the corresponding side-stream draw tray. Most of these fractions generated in the atmospheric distillation column can be sold as finished products after a hydrotreatment, or blended with products from downstream processes. Many refineries have more than one atmospheric distillation unit.

The operating conditions of the tower are based on the properties of the crude oil and the desired product yields and quality. Every refinery has a crude distillation unit designed for a selected crude (mix).

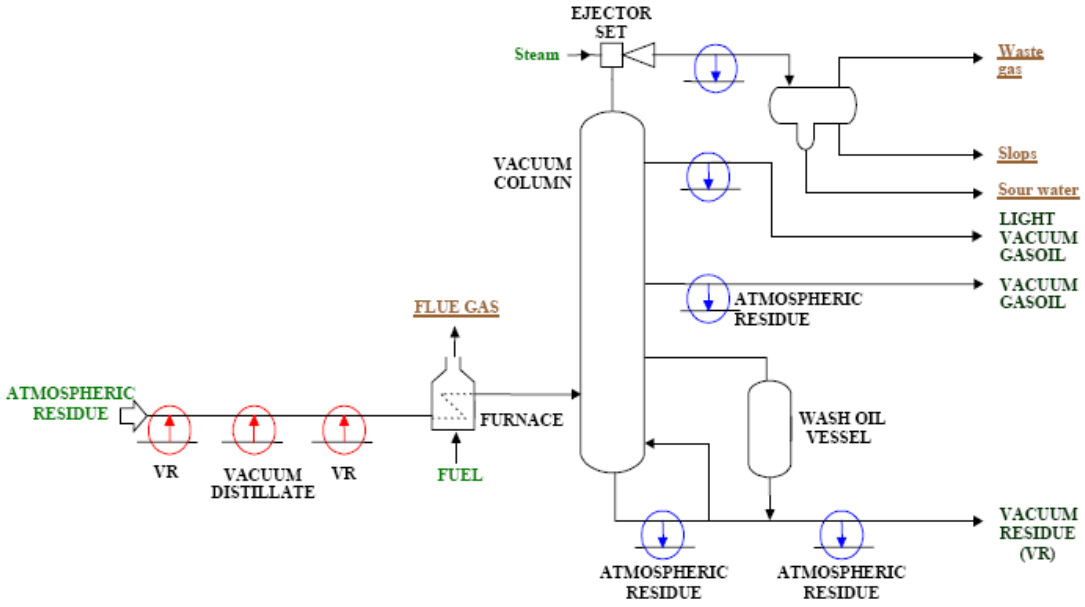


Simplified process flow diagram for a crude distillation unit

d) Process description of vacuum distillation

Atmospheric residue is heated up to 400 °C, partially vaporised (30 – 70 % by weight) and flashed into the base of the vacuum column at a pressure between 40 and 100 mbar (0.04 to 0.1 kg/cm^2). The vacuum inside the fractionator is maintained with steam ejectors, vacuum pumps, barometric condensers or surface condensers. The injection of overheated steam at the base of the vacuum fractionator column further reduces the partial pressure of the hydrocarbons in the tower, facilitating vaporisation and separation. The unvaporised part of the feed forms the bottom product and its temperature is controlled at about 355 °C to minimise coking. The flashed vapour rising through the column is contacted with wash oil (vacuum distillate) to wash out entrained liquid, coke and metals. The washed vapour is condensed in two or three main spray sections. In the lower sections of the column, the heavy vacuum distillate and optional medium vacuum gasoil are condensed. In the upper section of the vacuum column the light vacuum distillate is condensed. Light (noncondensable) components and steam from the top of the column are condensed and accumulated in an overhead drum for separating the light non-condensables, the heavier condensed gasoil and the water phase.

The most important operational aspect of a vacuum unit is the quality of the heavy vacuum gasoil, especially when this is fed to a hydrocracker unit. The Concarbon level and/or metal content is very critical for a hydrocracker unit and depends on the operation and performance of specially the wash oil section in the vacuum distillation unit as well as the desalter in the crude distillation unit.

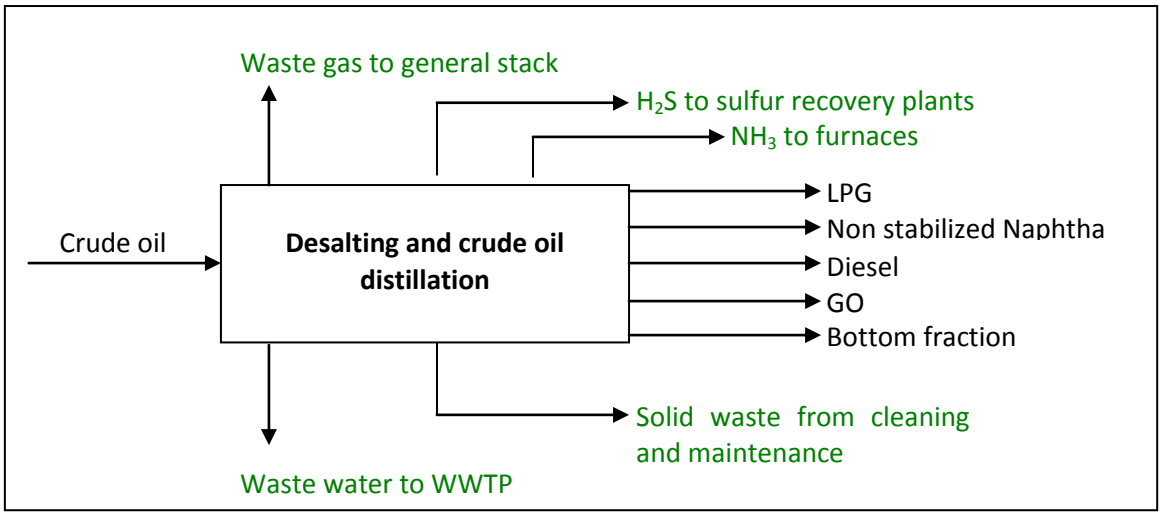


Simplified process flow scheme for high-vacuum distillation unit

2.- DESCRIPTION OF THE UNIT

2.1.- General description of the unit

The primary distillation of crude oil is the very first part of the refinery, the chart of the unit is as follows:



The main process to obtain all the different products from crude oil is the crude oil distillation. The refinery used for this case study has two units of crude oil distillation.

The two units have a capacity of 8.500.000 t of crude oil a year together. In these units, the crude oil is separated into different fractions depending on their boiling point: LPG, naphtha, kerosene, diesel, etc.

We can find the follow sections and equipment:

- Feeding system with pumps that transport the crude oil from storage tanks to the units, giving the proper pressure to be able to introduce them to the process.
- Heat exchangers, that heat the crude oil before and after the desalting units using the hot flows from the same unit.
- Desalting units, where the salt within the crude oil is eliminated through water injection.
- Loading furnace, to increase the temperature of crude oil until the necessary temperature for fractioning.
- Distillation column, where all the crude oil components are separated into fractions, from lightest ones, extracted through the head of the column, until the heaviest ones, extracted through the bottom of the column. There are also several lateral extractions for intermediate products.

- Stripping columns, where the lightest products of the three intermediated fractions are removed. The objective is to remove light components from kerosene, diesel and atmospheric gas oil, in order to reduce their ignition point.

The fractions obtained in the crude distillation are:

- LPG
- Non stabilized naphtha
- Kerosene
- Diesel
- Atmospheric GO
- Atmospheric waste, that is the bottom fraction that is not possible to distillate under atmospheric conditions.

Nearly all that fractions are processed afterwards in other refinery units to obtain final products.

- LPG and naphtha is used downstream in a concentration gas unit to obtain fuel gas, concentrated LPG and estabilyzed naphtha. Fuel gas is desulfurated and used to produce energy in the cogeneration units and sold. LPG is conducted to a “merox” unit where propane and isobutene are produced, the propane is sold and isobutene is sent to a isobutene unit to obtain propellants and butane. Naphtha is sent to re-distillation unit and sent to isopentane unit and a merox unit to finally blend it in the final formulation of gasoline.
- Kerosene is desulfurated and used as aviation fuel or blended in the final formulation of automotive diesel.
- Disesel is desulfurated and blended in the final formulation of automotive diesel.
- Atmospheric gas oil is desulfurated and blended in the final formulation of automotive diesel.
- Atmospheric waste is used as heavy fuel oil, or is re-distillated in a vacuum distillation unit and different grades of gas oil are obtained (heavy and light vacuum gas oil). Also a residual flow is obtained, called vacuum waste, that is sent to a visbreaking unit where naphtha could be recovered and the final waste is sent to a blending unit where different grades of fuel oil are obtained.

The most important parameter in distillation process is the temperature, which is controlled at the exit of the loading furnace, and must be around 350 ºC. Operation pressure is approximately of 0,7 kg/cm^2 at the head of the column.

The furnace has a pre-heating system to warm the entering combustion air. The system consists of the recovering of the energy from the combustion exhaust air, that left the unit at a very high temperature, to warm the combustion air that will be used in the furnace.

With that heat exchange, the combustion air is already pre-heated before entering the furnace and that involves less consumption of fuel oil in the furnace itself. So that system achieves a double objective: energy saving and less polluted air emissions.

From the point of view of waste water it must be said that this unit has a waste water pre-treatment system in order to re-use water in the unit itself. The process is known as "double stripping of acid waters" and consists of collect all the condensated flows of process steam, and remove H_2S and NH_3 and re-use the water sending it to the crude oil desalting unit. The H_2S is recovered in the sulfur recovery plants (super Klauss processes) and the NH_3 is burned in the crude oil furnaces itself.

2.2.- Raw materials and products

The most important raw material in this unit is the crude oil, but there are also some important auxiliary raw materials.

Raw material	Consumption	Storage	Storage facilities
Crude oil	8.500.000 t/y	570.000 t	7 atmospheric cylindrical tanks with floating roof
Catalyst	90 t/y	380 t	Several tanks and storage facilities
Anthracite and silica sand	30 t/y	41 t	Several tanks and storage facilities
Rasching/pall rings	7 m^3/y	19 m^3	Several tanks and storage facilities
Ceramic balls	23 t/y	15 t	Several tanks and storage facilities
Steam and condensate treatment products	8.000 t/y	5 t	Several tanks and storage facilities
Additives	13.000 t/y	14 t	Several tanks and storage facilities
Oils and greases	4.500 t/y	58 t	Several tanks and storage facilities
Other	90.000 t/y	150 t	Several tanks and storage facilities

And the obtained products (most of them are the output after other subsequent processes, but all of them originate in this unit) are:

Product	Amount produced	Storage	Storage facilities
LPG	175.000 t/y	16.000 t	Pressured aerial spheres
Kerosene	745.000 t/y	60.000 t	Atmospheric aerial tanks
Fuel oil	1.500.000 t/y	325.000 t	Atmospheric aerial tanks
Gas oil	3.700.000 t/y	400.000 t	Atmospheric aerial tanks
Gasoline	1.400.000 t/y	120.000 t	Atmospheric aerial tanks

2.3.- Energy use and consumption

The total contracted power of the refinery is 57MW and the total consumption is approximately of 450.000 MWh in electrical energy.

The annual consumption of electrical energy from refinery sources is 445.000 MWh and the external annual consumption of electrical energy is 5.000 MWh.

The consumption of different fuels is:

350.000 t/y of fuel oil
430.000 t/y of fuel gas
145.000 t/y of natural gas
3.800 t/y of gas oil

2.4.- Water

2.4.1.- Water consumption

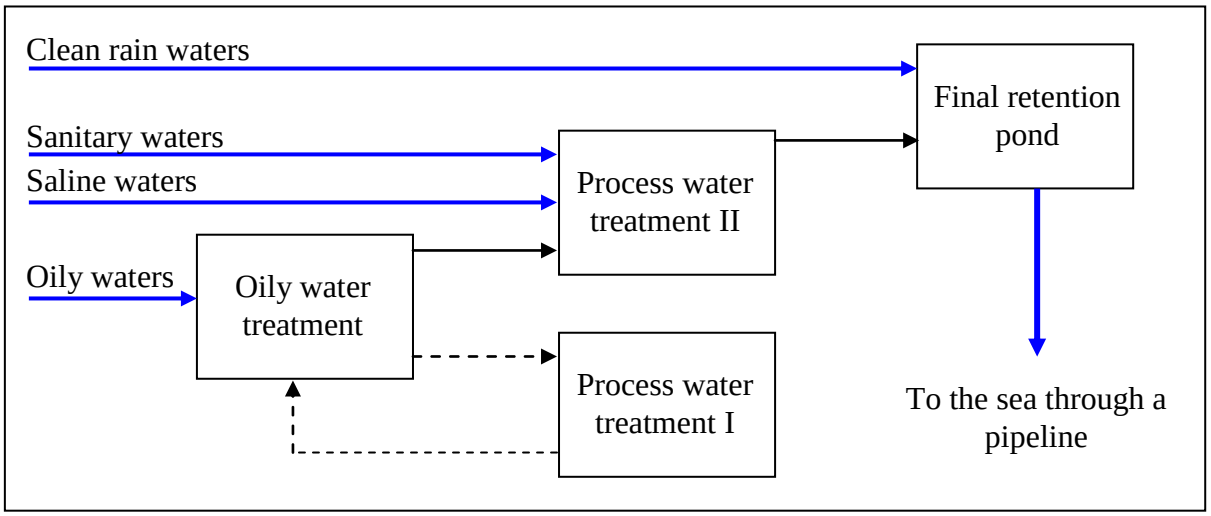
The total consumption of water per year is 7.500.000 m^3/y and comes approximately 50% from Ebro river and 50% from Gaià river.

The uses of the water are 65% refrigeration, 30% production process, 5% cleaning, sanitary and irrigation.

2.4.2.- Waste water

The total amount of waste water generated in the refinery is sent to a Waste Water Treatment Plant (WWTP). The kind of treatment is primary, physicochemical and biological. The total maximum capacity of treatment is 290 m^3/h.

The waste water in the refinery is separated into different flows depending on their quality and pollutants, the general scheme being as follows:



The discharge to the sea is done through a pipeline that follows the same route as the pipeline rack explained in section 1.1.

The total discharged flow is 7.200 m^3/d, or 2.650.000 m^3/y and the total capacity of the waste water pipeline is 1080 m^3/h.

As all the waste water is treated and discharged together, there is only one final discharging point, located at the following coordinates:

UTM X: 350.000
UTM Y: 4.500.000

The pollutants emitted are:

- Total suspended materials: 50 – 85 mg/l
- Organic matter: 90 – 125 mg of O_2/l
- Conductivity: 2000 – 3000 microsiemens/m^3
- Inhibitory substances: 2 -3 equitox/m^3
- Total N: 12 – 27 mg/l
- Total P: 1,5 – 1,9 mg/l

The parameters that are auto controlled periodically are:

- pH every day
- COD, and total hydrocarbons, every week
- Total suspended materials, conductivity, inhibitory substances, N, P and total organic compounds, eight times a year.

2.4.- Air

2.4.1.- Channeled air emissions

The total polluted air emissions in the example unit are channeled through the same general stack located at:

UTM X: 351.000
UTM Y: 4.550.000

The height of the stack is 113,8 m and the inner diameter is 7,76 m.

There are no especial correcting measures for air pollutants because the emissions are controlled by improving the quality of fuels used to heat the unit.

The stack is equipped with four measurement points and a platform. The measurement points are located at 3 times the diameter length from the outside and 6 times the diameter length from the last perturbation.

The general parameters of emission are:

- Flow: 1.200.000 m^3/h
- T: 200 ºC
- O_2: 12,5%

The pollutants emitted are:

- Opacity: 1 – 2 opacity index
- SO_2: 500 ppm
- NOx: 100 ppm
- H_2S: < 0,2 mg/Nm^3
- CO: 15 ppm
- PM: 50 mg/Nm^3

In addition, some of the pollutants are controlled continuously with automated measurement systems calibrated according to EN 14181. The parameters and pollutants controlled continuously are:

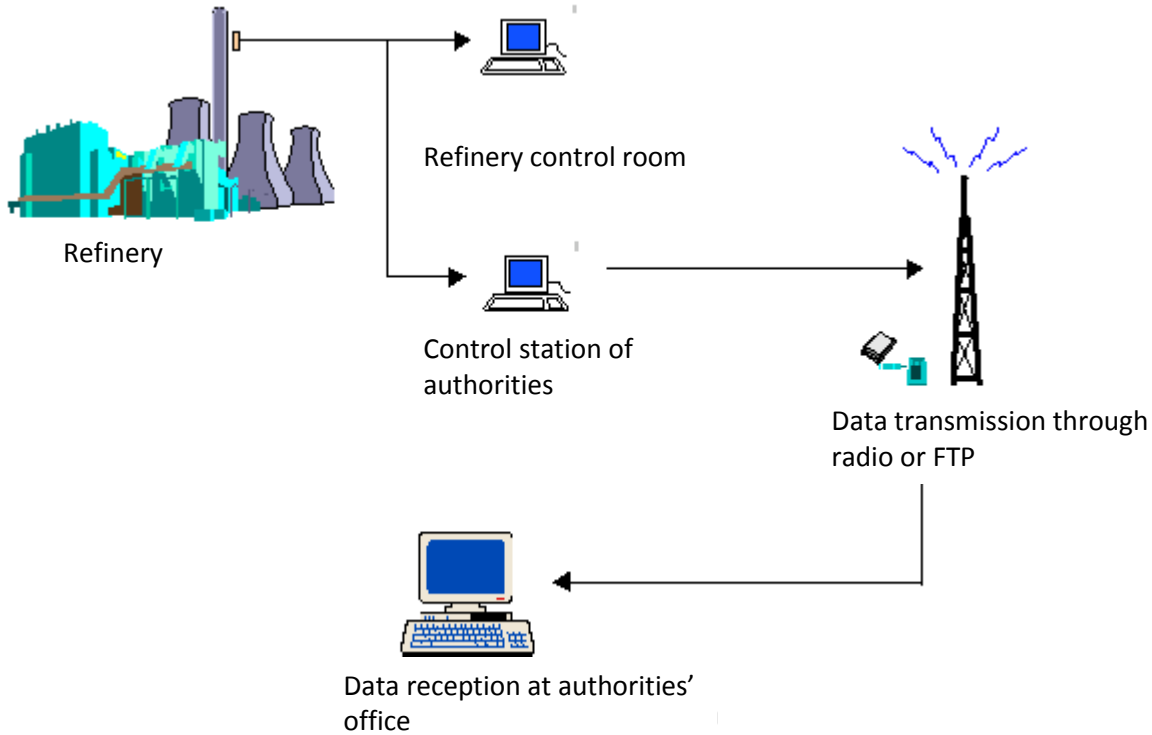
- SO_2
- NO_X (expressed as NO_2)
- PST
- O_2
- Flow
- T

According to the standard EN 14181 the calibration program is the following:

- All the automated measuring systems (AMS) fulfill the assurance quality level 1 (QAL1) according to the manufacturer (QAL1 certificate)
- Every year an annual surveillance test (AST) is practiced, with a previous functionally test
- After the installation of the AMS and every four years, a procedure (QAL 2) to calibrate the AMS and determine the variability of the measured values obtained. The procedure consists in comparing 15 values provided by the AMS with the same values obtained through a reference method and calculates if the difference is statistically significant or not..
- A periodical procedure (QAL 3) to maintain and demonstrate the required quality of the measurement results during the normal operation of an AMS, by checking that the zero and span characteristics are consistent with those determined during the certification.

In addition, the way how all the generated data is collected is checked and has to be completely confirmable for the authorities.

The data collected must be sent to local authorities following the protocols set for the “air emissions network” through radio or telephone connection.



2.4.2.- Diffuse air emissions

The diffuse emissions in this refinery are caused by the presence of volatile hydrocarbons flowing through pipes, equips, storage tanks, etc. and where no total sealing could be guaranteed, because of the joints, vents, loads and unloads, etc.

As the refinery is working continuously, there are diffuse air emissions also in a continuous way. It is possible to distinguish two kind of diffuse emissions:

Process diffuse emissions: Directly related with the kind of equipment (valves, flanges, pumps, compressors, etc.) their dimensions and the volatility of the hydrocarbons flowing through that equipment.

Storage diffuse emissions: These emissions depend on the kind of storage tank, dimensions, color, conservation, type of product, weather conditions and number of operations of load and unload.

In general, we can say that the pollutants emitted are volatile hydrocarbons, and there are estimations about the amount of diffuse emissions with a simulation program. Using an emission estimation program and the EPA emission factors, the result is that the emissions are of 608 t/y only for the storage tanks and 77 t/y for the distillation unit.

2.4.3.- Emissions through flares

This unit and the rest of the refinery use a flare as a safety system to treat discharges from any unit in case of emergency shutdown, electrical failure or any other anomalous situation. To this system are also sent other gases from purges, safety valves, vents or any other discontinuous combustible flows to avoid sending them directly to the atmosphere without being treated.

To estimate the work time of the flare it could be assumed that it is running 24h/day all the year, because, although there is no continuous flow sent to the flare, there are a lot of discontinuous flows sent to it so it could be assumed that it will be running almost in a continuous way.

The flare is located at:

UTM X: 350.000
UTM Y: 4.500.000

The height of the flare is 100 m and the inner diameter is 1,5 m.

As there are a lot of units sending flows to the flare the composition of combusted gases in this facility could be very different depending on the moment when is checked. As an

approximation, all the units that can send flows to the flare have been analyzed and quantified, and an average composition has been calculated:

Approximate composition of gases sent to the flare (volumetric %):

- Hydrogen 50%
- Methane 20%
- Nitrogen 10%
- Ethane and ethylene 6%
- C3 5%
- C4 4%
- C5+ 3.5%
- SH_2 1.5%

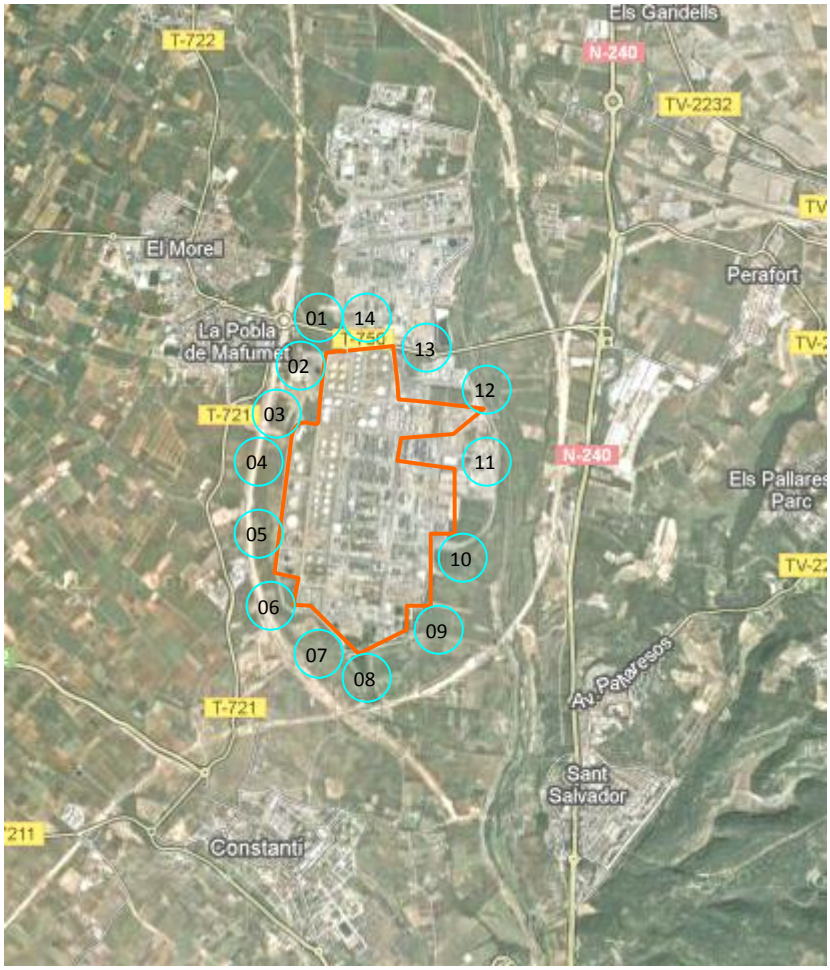
The maximum capacity of that flare is 1.140 t/y

In addition, it must be mentioned that immediately before the flare, a recovery system is located. This recovery system is basically a compressor with a capacity to liquefy 2t/h of gases that will be reused in the process as fuel-gas. There is a double benefit in the use of this system, in one hand there is a reduction in air emissions and in the other and, there is a reduction on energy consumption.

2.4.4.- Noise Emissions and vibrations

There are a lot of points where noise can be generated as compressors, reactors, cogenerations, pumps, flare, etc. Considering the distance between the refinery and the nearest populated zones, it is not expected to generate problems to the neighborhood.

Some measurements have been performed in the perimeter of the refinery:



Point	Equivalent Level Day (dBA)	Equivalent Level Night (dBA)
01	60,4	61,4
02	60,0	60,1
03	52,7	52,0
04	51,8	51,0
05	48,8	45,8
06	44,3	40,3
07	46,9	43,9
08	52,5	52,8
09	60,4	60,0
10	68,2	68,1
11	64,2	64,4

12	64,9	64,9
13	52,1	50,1
14	60,6	60,4

In addition there are some isolation elements in order to reduce the emission of noise:

- Soundproofing cabins to encapsulate the cogeneration units
- Absorbent materials of special mineral wool installed at the exit of valves and pipelines.
- Noise dampers in some electrical motors
- Silencers in some critical vents
- Sound screens and baffles to surround the ventilator of crude oil pumps

2.5 Waste management and soil pollution

2.5.1 Waste management

There is a variable generation of waste in the refinery, that is because non continuous waste is generated in the case study unit or any other unit (in fact, continuous generation of waste only occurs in the waste water treatment plant which generates continuously sludge).

So, waste generation is not continuous but depends on the periodicity of some maintenance operations:

- Cleanings that generate oily sludge, ashes and slag.
- Repairs that generate refractory materials, scrap metal, general waste, woods, alumina changes, ion exchange resins, catalyst, etc.

All that waste may be generated one year and maybe not the next one, or even generated only once every 4 or 5 years.

The following table shows the waste generation and storage for the last year:

Waste	Process where is generated	Production	Storage
Hydrocarbons	Maintenance	22 t	15 t
Oily sludge	Cleaning and maintenance	110 t	30 m^3
Caustic soda	Fuels cleaning	38 t	-
Sludge from water boilers	Boiler water treatment	228 t	500 t
$CaCO_3$	Boiler water treatment	2935 t	500 t
Ashes and dust of boilers	Cleaning of boilers and furnaces	23 t	20 t
Blasting sands	Metallic surface treatments	330 t	330 t
Mineral oil	Lubrication	153 t	-
Containers and packaging	All kind of packaging with	20 t	20 t

	rests of dangerous materials		
Gasoil filters	Filtration	4 t	4 t
Laboratory products	Laboratory analysis	0,2 t	0,2 t
Lead batteries	Batteries, cells, and others with lead	1.5 t	1.5 t
Alumina waste	Catalyst change	35 t	35 t
Wasted catalyst	Catalyst change	94 t	50 t
Refractory material	Refractory maintenance	90 t	200 t
Dirty grit	Maintenance	30 t	100 t
Isolation material	Isolation maintenance	48 t	30 t
Dried sludge from WWTP	Waste water treatment plant	380 t	100 t
Ion exchange resins	Water treatment	8 t	12 t
Paper and cardboard	General waste	6 t	6 t
Fluorescent tubes	General waste	4 t	3 t
Domestic batteries	General waste	0,4 t	0,4 t
Wood	Packaging	42 t	60 m^3
Plastic	Packaging and general waste	7 t	7 t
Metal scrap	Maintenance operations	500 t	200 t
General waste	General waste	1200 t	10 t

2.5.2 Soil pollution

There is a monitoring plan to check if soil pollution is taking place. Some general studies of soil have been done with the following actuations:

- Electromagnetic induction geophysical prospection
- Georadar prospection
- ROST (rapid optical screening tool) prospection
- And mechanical prospection with the construction of 41 piezometers

In some groundwaters were detected dissolved hydrocarbons, but not a free layer presence. Non polluted water downstream was found.

There is a prevention program with the following issues:

- Maintenance of existing storage tanks, with the objective of failure detection and correction, mainly at bottom of tanks before a hypothetical accidental release.
- In new tanks construction, take special care of soil protection. Under the metallic part, there is a disposal of different layers of sand, silt and fiber and plastic to ensure that if there is a leakage it will not pollute the soil. In addition, some witness tubes are installed at the surroundings of the tank to check rapidly if there is a release.

- Underground pipelines maintenance to avoid corrosion. Some hydraulic test are practiced to check if there is a pore. If it is possible, underground pipelines are converted to aerial pipelines.
- Periodical monitoring for the 41 piezometers network.
- Cathodic protection of underground pipelines to avoid corrosion. There is a program to protect all the lines, until know, there are a 66% of protected lines.