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Summary of Comments on Mod. 1809-10_Type A_PROJ_E_1

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**ASSIUT HYDROCRACKING COMPLEX
ANOPC**

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1 GENERAL

An Environmental Protection Design Criteria has been developed with the intent to identify the design philosophy for the environmental protection of Assiut Refinery within the Assiut Hydrocracking Complex (AHC) Project.

Design criteria under the scope of the present document are applicable only to:

- New units;
- Revamped units, on a case by case analysis and under judgment of Contractor only.

The design criteria given in present document are not applicable to the existing units in the Assiut Refinery.

2 OBJECTIVES

For Air Quality limits, the project shall consider the limit set by current Egyptian environmental regulation since IFC states "Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that: Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO (World Health Organizations) Air Quality Guidelines...".

Project design shall aim to:

1. Safeguard the environment, and where possible improve the environmental condition;
2. Eliminate the use of environmental hazardous material from the design wherever practicable, and select lower toxicity chemicals over higher toxicity chemicals;
3. Minimize energy demand and maximize energy efficiency;
4. Avoid waste generation and minimize both the quantities of waste generated and the hazards of the waste;
5. Reduce air emissions by process design and through energy optimization;
6. Avoid venting of gases and minimize diffuse gas losses.
7. Design process systems to minimize flaring.

In particular, the design shall reduce the quantities and volumes of air and aqueous emissions to environment and solid waste.

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3 REFERENCES

- [1] Law N° 4 of 1994 amended by Law N° 9 of 2009 and Law 105 of 2015 and its Executive Regulations (ER) issued by the Prime Minister's Decree N° 338 of the 1995 amended by Prime Minister's Decree N° 710 of 2012 and Prime Minister's Decree N° 618 of 2017.
- [2] IFC EHS General Guidelines (April 30, 2007)
- [3] IFC EHS Guidelines for Thermal Power Plants (December 19, 2008)
- [4] IFC EHS Guidelines for Petroleum Refining (November 17, 2016)
- [5] **Decree No. 402 of the year 2009 Amending the Executive Regulations of Law No. 48/198 Regarding the Protection of the River Nile and Waterways Against Pollution, Amended as per Decrees No. 219/2010, 383/2011 and 92/2013.**

4 AIR POLLUTION**4.1 Air Quality Standard (AQS)**

The impact to ambient air quality should be minimized by ensuring that:

- Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards as per Table 1;
- Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, IFC Guideline [2], recommends to comply with 25% of Air Quality Limit for new installations taking into account the existing plants and the future ones.

At facility level, impacts should be estimated through qualitative or quantitative assessments **to be developed in the ESIA study** by the use of an atmospheric dispersion model to assess potential ground level concentrations, **taking into account** the target air quality standard shown in Table 1.

However, the air quality level at industrial complex area depends on the emissions of many different industrial entity (including existing plants), thus the compliance with environmental regulation will be verified by a dedicated environmental social impact assessment (ESIA) taking into account all the emission point source present in the area that may affect the airshed under study.

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Table 1 - Ambient Air Quality Standard

Pollutant	Threshold ($\mu\text{g}/\text{m}^3$) for Industrial Zone	Average period	Reference
SO ₂	150	24 h	Ref. from Egyptian reg. [1], while Ref. from IFC EHS [2] is more restrictive; however not applicable
	350	1h	Egyptian reg. [1]
	60	1 year	Egyptian reg. [1]
Suspended Particulate Matter (As Black Smoke)	150	24 h	Ref. from Egyptian reg. [1]; not covered in Ref. IFC EHS [2]
	60	1 year	
Suspended Particulate Matter (Total Suspended Particulate)	230	24 h	Ref. from Egyptian reg. [1]; not covered in Ref. IFC EHS [2]
	125	1 year	
Particulate Matter PM10	70	1 year	Egyptian reg. [1]
	150	24 h	Egyptian reg. [1]
Particulate Matter PM2.5	50	1 year	Egyptian reg. [1]
	80	24 h	Egyptian reg. [1]
CO	30 mg/m ³	1h	Egyptian reg. [1]
	10 mg/m ³	8h	Egyptian reg. [1]
NO ₂	80	1 year	Ref. from Egyptian reg. [1], while Ref. from IFC EHS [2] is more restrictive; however not applicable
	150	24 h	Egyptian reg. [1]
	300	1 h	Ref. from Egyptian reg. [1], while Ref. from IFC EHS [2] is more restrictive; however, is not applicable
Ozone	120	8 h daily maximum	Ref. from Egyptian reg. [1], while Ref. from IFC EHS [2] is more restrictive; however not applicable
	180	1 h	Egyptian reg. [1]
Lead	1	1 year	Egyptian reg. [1]
Ammonia	120	24 h	Egyptian reg. [1]

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4.2 Air Emission Limits (Point Emission Sources)

For new installation all continuous point source emissions (e.g. stack emissions) to atmosphere shall comply with the most stringent emission figure between local Egyptian regulation and IFC Guidelines. Limits for various pollutants applied to present project are specified in Tables 2,3 and 4 below. Table 2 and Table 3 are referred to furnaces and boilers fed by fuel gas/natural gas with the purpose to deliver heat to a process stream. For equipment where a process stream is treated by combustion such as Claus reactor and incinerator Table 4 shall be considered.

Table 2 – Air Emission Limits for Small Combustion Facilities (3MWth - 50MWth)

Pollutant	Threshold (mg/Nm ³)	Reference
	Gas fuel	
Particulate Matter (PM)	25	IFC EHS [4] ^(a)
Nitrogen Oxides (NO _x)	300	IFC EHS [4] ^(a)
Sulfur Oxide (SO ₂)	500	Egyptian reg. [1] ^(a) and IFC EHS [4] ^(a)
Carbon Monoxide (CO)	100	Egyptian reg. [1] ^(b)
Vanadium	5	Egyptian reg. [1] ^(a) and IFC EHS [4] ^(a)
Nickel	1	Egyptian reg. [1] ^(a) and IFC EHS [4] ^(a)
H ₂ S	5	IFC EHS [4] ^(a)

(a) Limits are referred to dry gas at 3% O₂ Excess.

(b) Limits are referred to dry gas at 4% O₂ Excess.

Table 3 – Air Emission Limits for Combustion Facilities (Power Greater Than 50MWth)

Pollutant	Threshold (mg/Nm ³)		Reference
	Natural gas fuels	Other gaseous fuels	
Particulate Matter (PM)	(c)	25	IFC EHS [4] ^(a)
Nitrogen Oxides (NO _x)	240	240	IFC EHS [3] ^(a)
Sulfur Oxide (SO ₂)	(c)	400	IFC EHS [3] ^(a)
Carbon Monoxide (CO)	100	100	Egyptian reg. [1] ^(b)
Vanadium	5	5	Egyptian reg. [1] ^(a)
Nickel	1	1	Egyptian reg. [1] ^(a)
H ₂ S	5	5	IFC EHS [4] ^(a)

(a) Limits are referred to dry gas at 3% O₂ Excess.

(b) Limits are referred to dry gas at 4% O₂ Excess.

(c) IFC does not provide an emission guideline figure; however, the threshold for Other gaseous fuels shall not be exceeded.

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For all other stack which are not covered by above Table 2 and 3, following thresholds have to be adopted.

Table 4 – Air Emission Limits for Other Stacks		
Pollutant	Threshold (mg/Nm ³)	Reference
Particulate Matter (PM)	25	IFC EHS [4] ^(a)
Nitrogen Oxides (NO _x)	300	IFC EHS [4] ^(a)
Sulfur Oxides (SO ₂)	150 for Sulphur Recovery Unit 500 for other units	Egyptian reg. [1] ^(a) and IFC EHS [4] ^(a)
Carbon Monoxide (CO)	100	Egyptian reg. [1] ^(b)
Vanadium	5	Egyptian reg. [1] ^(a) and IFC EHS [4] ^(a)
Nickel	1	Egyptian reg. [1] ^(a) and IFC EHS [4] ^(a)
H ₂ S	5	IFC EHS [4] ^(a)

(a) Limits are referred to dry gas at 3% O₂ Excess.

(b) Limits are referred to dry gas at 4% O₂ Excess.

Process heaters and Boilers

Low NO_x burners shall be specified on all new fired sources as minimum. During the EPC stage of the Project, Fired heaters Vendors shall be asked to guarantee that air emissions will not exceed the limits shown in Table 2 and Table 3.

Stack height will be preliminarily calculated based on draft requirements and minimum height for pollutant dispersion, as per Egyptian Regulation [1].

Stack heights will be confirmed by air quality modelling performed during Environmental Social Impact Assessment (ESIA).

Flare

All hydrocarbons gas/vapour discharges from operating process vents and pressure relief devices shall be collected and routed to flare or recycled to process.

New flare must be designed to meet the requirement for destruction efficiency of 98% or greater.

New flare shall be provided with steam injection for smokeless operation up to 15% of flare design load.

4.3 Air Quality Monitoring System

Equipment for measuring and recording air quality data at specific locations inside and outside refinery fence will be installed by the project. Number, position, pollutants to be monitored and equipment type (continuous or sample monitoring at given time interval) will be suggested by the ESIA based on air quality dispersion model.

4.4 Stack Monitoring Requirements

Continuous Emission Monitoring System (CEMS) will be implemented to perform continuous monitoring of stack flue gas pollutants (including Particulate Matter). CEMS will be connected by

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OWNER to Environmental Egyptian Affairs Agency (EEAAA) transferring data via mobile network and should comply with EEAA requirements as highlighted in EEAA guidelines (in their authorized website).

4.5 Fugitive Emissions

Fugitive emissions refer to non-point emissions of Volatile Organic Compounds (VOCs) and Greenhouse Gases (GHGs) from piping components and equipment including valves, flange connectors, pumps and compressor seals, relief valves, sampling connections, process drains and open-ended lines.

VOCs (e.g. ethane, ethylene, propane, propylene, butanes, butylenes, pentanes, pentenes, C6-C9 alkylate, benzene, toluene, xylenes, phenol, C₉ aromatics, gasoline, n-Hexane, Methyl Mercaptan) can react with NO_x in the presence of sunlight to form low-level atmospheric ozone.

Fugitive Emissions Control

The design criteria for facility piping components in VOC and GHG service shall be in accordance with the following:

- The number of flange connections should be minimized.
- Open-ended lines are to be capped, blinded, plugged, or double valved.
- Pumps handling light hydrocarbons or toxic fluids shall be equipped with double mechanical seals and either the use of a barrier fluid at a higher pressure than the process fluid, or the barrier fluid seal pot shall be vented to the flare header. Alternatively, pumps handling these fluids may consist of a sealless pump design (magnetic drive or canned motor). **For more details, please refer to Table 10-1 in project document "Basic Process Design Requirements and Criteria" coded as 079254C-0000-JSD-0000-02.**
- All relief valves in the processing area that are in VOC service shall preferably discharge to the flare header; as an alternative relief valve in series with rupture disk shall be applied for atmosphere discharge. Centrifugal compressors shall have dry gas seals with seal gas and nitrogen separation gas. The seals shall be vented to the flare header.
- Sample connections in VOC service shall be of closed-loop design.
- Storage tanks containing volatile liquids with a maximum true vapour pressure at storage conditions greater than or equal to 76.6 kPa shall be provided with a closed vent system and control device (for definition refer to ref. [1] and ref. [4]). Floating roof tanks will be provided with liquid mounted primary seals and secondary seal system (rim mounted, or shoe mounted). All tanks will be painted with light colours to minimize vaporization.

Control device means an equipment other than inherent process equipment that is used to destroy or remove air pollutant prior to discharge into the atmosphere.

5 Wastewater Discharge

All the effluent coming from the new process and utilities units will be treated to obtain a water quality suitable **to be discharged into Al-Jabal non-fresh water body**. Requirements for **these Treated Industrial Liquid Water**, have been selected taking into account the most stringent value

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from the ones established by Egyptian Regulations or IFC EHS guidelines. Where Egyptian Law lacks a defined limit value but refers the decision to a dedicated committee (e.g. P, N, NH3), limits from IFC EHS guidelines have been adopted, where available. Threshold limits shall be as follows:

Table 5 – Maximum Limit (mg/L) for the Standards of the Treated Industrial Liquid Wastes Discharged into		
Description	Threshold	Reference
Temperature	≤ 30 °C	Agreement Between ANOPC/PMC/TechnipFMC
Hydrogen Exponent (pH)	6-9	Egyptian Reg. [5]
BOD5	≤ 30 ppm	IFC EHS [4]
COD (Dichromate)	≤ 80 ppm	Egyptian Reg. [5]
Dissolved Oxygen	≥ 4 ppm	Egyptian Reg. [5]
Oil and Grease	≤ 10 ppm	Egyptian Reg. [5]
Total Dissolved Solids (TDS)	≤ 2000 ppm	Egyptian Reg. [5]
Suspended Materials (TSS)	≤ 30 ppm	IFC EHS [4]
Sulfide (as H ₂ S)	≤ 0.2 ppm	IFC EHS [4]
Cyanide (total)	≤ 0.1 ppm	Egyptian Reg. [5]
TP as P	≤ 2 ppm	IFC EHS [4]
Ammonia NH ₃ as N	≤ 3 ppm	From MIDOR Project
Total Nitrogen TN as N	≤ 40 ppm	IFC EHS [4]
Phenol	≤ 0.05 ppm	Egyptian Reg. [5]
Mercury	≤ 0.003 ppm	IFC EHS [4]
Lead	≤ 0.1 ppm	Egyptian Reg. [5]
Cadmium	≤ 0.003 ppm	Egyptian Reg. [5]
Arsenic	≤ 0.05 ppm	Egyptian Reg. [5]
Selenium	≤ 0.1 ppm	Egyptian Reg. [5]
Chromium (total)	≤ 0.1 ppm	Egyptian Reg. [5]
Chromium (hexavalent)	≤ 0.05 ppm	IFC EHS [4]
Copper	≤ 0.5 ppm	Egyptian Reg. [5]
Nickel	≤ 0.5 ppm	Egyptian Reg. [5]
Zinc	≤ 2 ppm	Egyptian Reg. [5]
Iron	≤ 1 ppm	Egyptian Reg. [5]
Vanadium	≤ 1 ppm	IFC EHS [4]
Benzene	≤ 0.05 ppm	IFC EHS [4]
Benzopyrene	≤ 0.05 ppm	IFC EHS [4]
Probable enumeration for the colonic group in 100 cm ³	1000	Egyptian Reg. [5]
Worm eggs (Ascaris) (*)	-	TechnipFMC scheme propose a thermic treatment of the sanitary water upstream the biological treatment and a final chlorination of the overall WWT effluent to reduce its biological hazard
All kinds of pesticides		
Aldrin and dieldrin	≤ 0.015 ppm	Egyptian Reg. [5]
Alachlor	≤ 0.1 ppm	Egyptian Reg. [5]

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Table 5 – Maximum Limit (mg/L) for the Standards of the Treated Industrial Liquid Wastes Discharged into		
Description	Threshold	Reference
Aldicarb	≤ 0.5 ppm	Egyptian Reg. [5]
Atrazine	≤ 0.1 ppm	Egyptian Reg. [5]
Bentazone	≤ 0.15 ppm	Egyptian Reg. [5]
Carbofuran	≤ 0.35 ppm	Egyptian Reg. [5]
Chlordane	≤ 0.01 ppm	Egyptian Reg. [5]
2,4 Dichloroprop	≤ 0.5 ppm	Egyptian Reg. [5]
Fenoprop	≤ 0.5 ppm	Egyptian Reg. [5]
Mecoprop	≤ 0.45 ppm	Egyptian Reg. [5]

Groundwater

Rain, fire or washing water on contaminated area will be recovered and treated according to pollutants content.

All storage tanks containing flammable, combustible or environment hazardous material have to be provided with secondary tank containment system (e.g. bund, dike or wall) around tanks. The available volume of secondary containment shall be in accordance to project criteria and, in any case, not less than 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location. The tank bund will be paved to be impervious (e.g. concrete).

To avoid contamination of ground water by tank bottom leakage, the storage tanks containing environmental hazardous substances will be provided with an impervious barrier (e.g. HDPE lining) associated with a leak detection system (visual inspection at “tell tale” leak detection points; in case of volatile product gas sensing at “tell tale” points could be carried out instead) or equipped with double bottom and adequate detection system.

6 Waste Management

Waste produced during the operation of the facility shall be collected, classified, stored and disposed to proper destination (e.g. waste treatment facilities, licensed landfills or incineration facilities depending on type).

The sources of operational liquid and solid wastes will include municipal or domestic refuse (waste paper and cardboard, food scraps, plastics, etc.), spent catalysts and adsorbents, waste lubricating oils, spent solvents, waste biological sludge, medical wastes, and other miscellaneous minor wastes such oil/solvent contaminated filter elements.

Oily sludge is one of the major generated waste. Waste minimization at source is required and the reduction of this waste is required before final disposal.

All wastes will be collected, stored, transported and disposed of in a manner to avoid adverse environmental, health and safety impacts.

The management of solid wastes will be in accordance with the following general guidelines:

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- Every effort should be made to eliminate or reduce solid wastes by means of operating practices and the reuse and recycle of usable materials wherever feasible.
- Liquid and solid wastes should be returned to supplier as conditions of purchase contracts wherever possible.
- All wastes not intended for internal or third party recycle/reuse are to be disposed of at approved disposal facilities.
- Solid wastes are to be collected in waste-specific (hazardous and non-hazardous) bins located within designated waste collection areas and transported to a secured, centralized waste operations area for sorting, consolidation, labeling and storage.
- Incompatible chemical wastes are not to be stored in the same area. Reactive, flammable, acid corrosive and caustic corrosive chemicals will be stored in their own segregated area hazardous wastes area that is to be segregated from nonhazardous wastes to ensure their proper management.

Particular attention shall be given to the identification and management of hazardous wastes.

6.1 Hazardous Wastes

Hazardous Waste means any waste that due to any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics cause danger or it is likely to cause danger to health or environment whether alone or in contact with other wastes.

Hazardous Waste present at least one of the following characteristics (but not limited to):

- Corrosiveness $2 > \text{pH} > 12.5$
- Reactivity
- Explosiveness
- Environmental Toxicity
- Radioactivity
- Flammability
- Oxidant Gas
- Biological-Infectious

Hazardous waste must be stored in adequate containers to prevent any leakage and properly labeled.

An on-site temporary storage before disposal outside should be defined. Temporary storage should be in a safe area and provided with adequate containment facilities to prevent spreading of wastes accidentally leaked from containers.

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7 NOISE

Noise impact during operation of new facilities shall not exceed the levels shown below according the Egyptian Law (Ref. [1]) and IFC General guidelines (Ref. [2]).

Table 6 – Permissible Limits of Noise Levels Inside Places of Work and Closed Places		
Type of Place/Activity	Maximum limit dB(A)	Exposure duration (Hours)
1. Places of work with up to 8 hour shifts	85	8
2. Offices, work rooms for computers or similar equipment	65	-
3. Work rooms for activities that require routine mental concentration. Control rooms for industrial activities, cafeterias and restaurants.	60	-

With reference to point in table above, the exposure duration is reduced to half with every increase in noise level equivalent to 3 dB (A).

In order not to affect the hearing sense, accompanied by wearing the appropriate earplugs, temporary noise level during working period should not exceed 115 dB.

With reference to noise level to be not exceeded at fence, the limit selected is the one indicated in Egyptian Regulation [1] relevant to "Industrial area" which is 60dB(A) night time and 70 dB(A) day time.

If existing noise values at fence line are greater than the 70 / 60 dB (A) (already at the permissible limit), the noise level increase due to contribute of new Units in Early Works scope of work shall be not greater than of 3 dB(A).