

4 Project Description

4.1 Baiji Refinery

There are 14 existing refinery plants in Iraq and these facilities are managed by the three (3) national oil refinery companies established in 1997, which are named North Refineries Company (NRC), Midland Refineries Companies (MRC) and South Refineries Company (SRC).

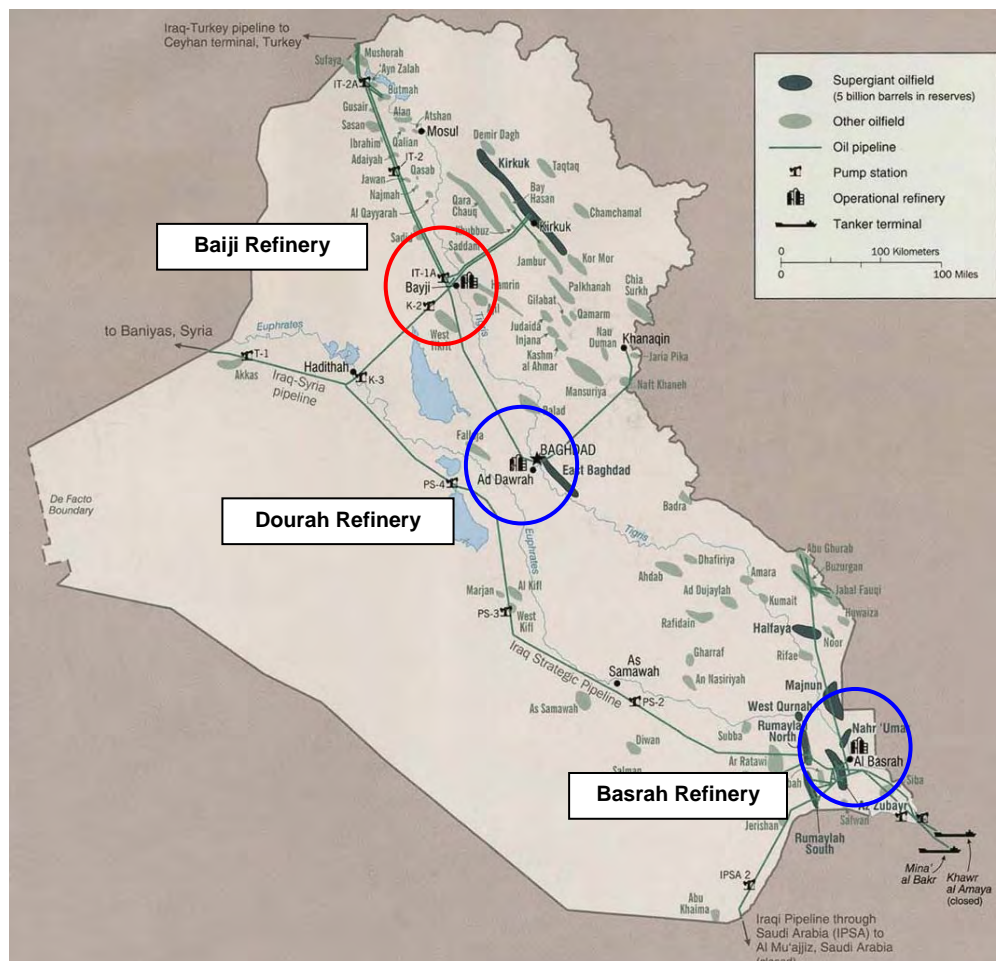


Figure 4.1-1 Refineries in Iraq

The Baiji Refinery under NRC, is a grass-root refinery constructed in 1978, and is located in the Baiji city of Salahuddin province, at the northern district of the country. The Baiji Refinery consisting of Baiji North and Baiji Salahuddin 1 & 2 Refinery plants are the largest refineries managed by NRC. The combined design capacity is 310,000 BPD in total.

Table 4.1 -1 Refineries in Iraq

Refinery	Design Capacity (BPSD)
North Refineries Company (NRC)	
- Baiji Refinery	
- Baiji North	170,000
- Baiji Salahuddin (1 & 2)	140,000
- Kirkuk	30,000
- Senitah	30,000
- Haditha	16,000
- Kisik	10,000
- Quarayah	14,000
Midland Refineries Company (MRC)	
- Dourah	110,000
- Samawa	10,000
- Najaf	20,000
- Dewania	10,000
South Refineries Company (SRC)	
- Basrah	180,000
- Nassiriya	30,000
- Maysan	10,000
Total	780,000



Source : Google

Figure 4.1-2 Baiji Refinery-General View

The respective refinery plants of the existing Baiji Refinery consist of the following main processing units.

Table 4.1-2 Processing Units in Baiji Refinery

Processing Unit	Design Capacity (BSPD)
Baiji North	150,000
Crude Distillation Unit	150,000
Naphtha HDS Unit	41,000
Platforming Unit	22,000
Kerosene HDS Unit	28,000
LGO HDS unit	31,000
Vacuum Distillation Unit	65,000
Hydrocracking Unit	38,000
Baiji Salahuddin 1	
Crude Distillation Unit	70,000
Light Distillate HDS Unit	29,000
Gas Oil HDS Unit	12,000
Catalytic Reforming Unit	8,000
LPG Recovery Unit	540 Tons/D
Baiji Salahuddin 2	
Crude Distillation Unit	70,000
Light Distillate HDS Unit	29,000
Gas Oil HDS Unit	12,000
Catalytic Reforming Unit	16,500



Figure 4.1-3 Baiji Refinery (1)

In addition to the processing units, the Baiji Refinery has auxiliary facilities including the storage tanks for the crude and products, loading system for the products, utility system such as steam generation, cooling water system, instrument and plant air system, power receiving and distribution system.



Figure 4.1-4 Baiji Refinery (2)



Figure 4.1-5 Control Room

The Baiji Refinery has the production capacities of the main oil products as below. The current operation rate of the refinery plants is fluctuated between 65-80% due to unstable power supply and frequent unplanned partial shutdown of the facilities.

Table 4.1-3 Capacity of Main Oil Products

Products	Capacity (BSPD)
Gasoline	60,700
Kerosene	49,000
Gas Oil (Diesel)	58,600
Fuel Oil	124,100
LPG	540 Tons/D

The products are delivered to the domestic markets through transportation by tanker trucks and railway.



Figure 4.1-6 Tanker Loading System

Crude, the feed stock of the Baiji Refinery, is supplied from the Kirkuk oil fields through the existing pipeline network in the region.

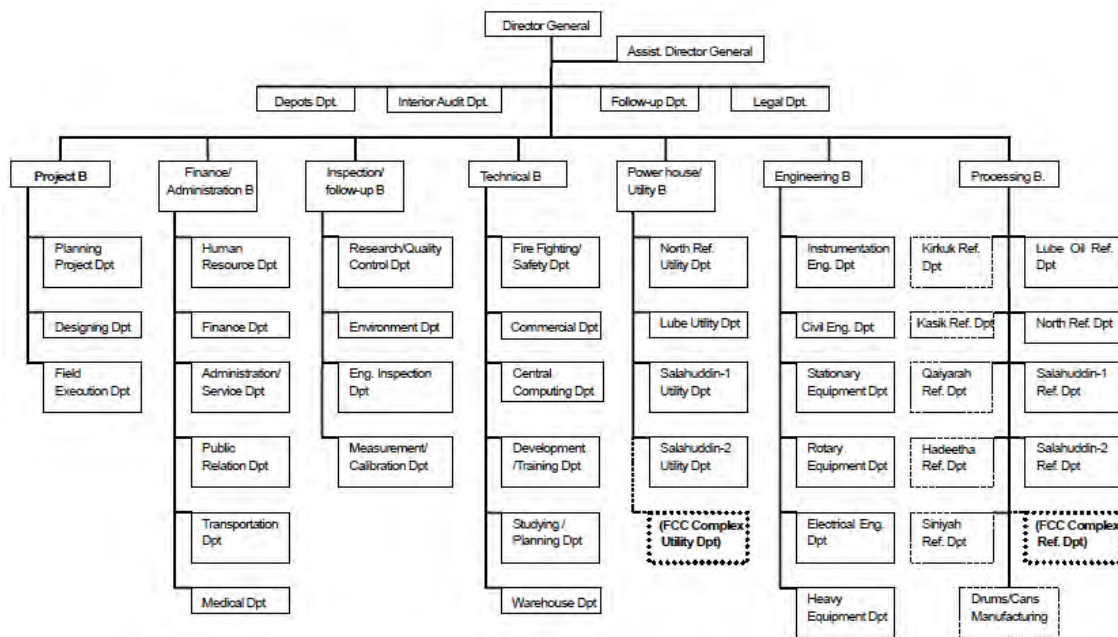
The power for operation of the Baiji Refinery is currently supplied from the 132kV and 400kV of regional grid. The existing power supply capacity to the refinery is 110MW/h and the current power consumption of the refinery is 85MW/h. However, due to the aging of the existing power generation plants and transmission system in the region, the refinery is susceptible to possible trouble and cause shortage of power supply and subsequently the interruption of stable operation of the facilities.

The water required for operation of the facilities is taken from the sub-stream of Tigris River which is routed in the east side of the refinery site. The water intake system supplies the water to the cooling water system, boiler feed water system, fire water system, etc. of the refinery.



Figure 4.1-7 Baiji Power Station

The operational organization of the North Refineries Company is shown below. Under the director general of the company, seven (7) operation boards are allocated, which are responsible for projects, finance & administration, inspection, technical, power house and utility, engineering and processing respectively. The operational departments for the refineries in NRC are provided in the processing board. The FCC Complex department will be newly formed in the same board after initiation of the project.



Source: NRC March 2009

Figure 4.1-8 Organization of North Refineries Company

The Environment Department responsible for environmental protection and management including monitoring is organized in the Inspection Board and the Public Relation Department in charge of the social issues is provided in the Finance & Administration Board.

The Environmental Department has a function to manage the current environmental plans for the refineries operation including the environmental protection and monitoring activities in accordance with the regulatory requirements as well as coordination with the relevant authorities.

4.2 Project Summary

The Ministry of Oil (MOO) will initiate a project for the upgrading of Baiji Refinery by installation of FCC Complex in order to increase production of such oil products as gasoline and

diesel which could add product value further in the region. The FCC Complex proposed by MOO consists of the main and auxiliary processing units, utilities and related offsite facilities such as intermediate product tanks and others.

The main feed stock (Reduced crude: RCR) to the proposed FCC Complex is to be supplied from the existing refinery. The FCC Complex aims to produce high quality products such as approximately 28,300 BPSD of FCC gasoline with research octane number (RON) 90-91 and less than 10 ppm of sulfur content, diesel oil with less than 50ppm of sulfur content, fuel oil mix, LPG and other by-products.

The FCC Complex will consist of the main and auxiliary processing units, utility and related offsite facilities to be constructed within the battery limit of the Baiji Refinery. The Project requires interface alignment between the existing facilities and the FCC Complex on the following interactive aspects: coordination of feedstock supply system, products transfer system, control and data communication system, etc. and modification/addition of existing related facilities including products storage tanks, blending system, loading facility, etc.

In addition, for sustainable and sound operation of the FCC Complex, it is essential to ensure sufficient and stable supplies of main utilities such as electrical power, industrial water and fuels from the certain internal/external resources. Further, off-takers of not only the main products, but also by-products i.e. sulfur, heavy fuel mix, coke, etc. shall be guaranteed to ensure the commercial operation of the FCC Complex.

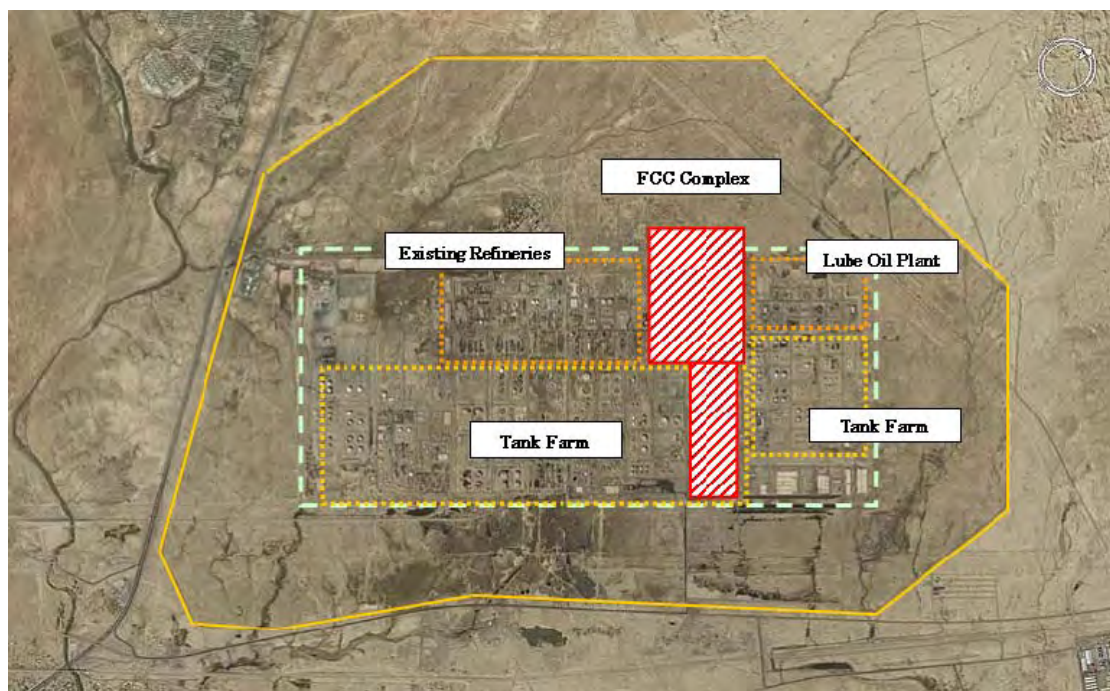


Figure 4.3.1 Site of FCC Complex

4.3 Proposed FCC Complex

4.3.1 Project Site

The FCC Complex will be located at the vacant facility area prepared for future expansion of the facilities within the boundary of the existing Baiji Refinery.

4.3.2 Extent of FCC Complex

The FCC Complex consists of the following facilities to be constructed within the battery limit of the Baiji Refinery.

- Main and auxiliary processing units
- Utility facilities (electric power, industrial water, fuel, steam supplies, etc.)
- Related offsite facilities (storage, loading system, etc.)
- Interface between the FCC Complex and the existing refinery
- Advanced process control system and safety and fire systems

4.3.3 Specification of FCC Complex

The FCC Complex will have the capacity to produce the following high quality petroleum products at least:

- 28,300BPSD of FCC gasoline with RON 90-91, less than 10ppm of sulfur content
- 5,400BPSD of diesel oil, less than 50ppm of sulfur content
- Others: fuel oil mix, LPG, naphtha, etc.

4.3.4 Feed stock

The main feed stocks for the FCC Complex to be supplied from the existing Baiji Refinery are as follows.

- Reduced Crude (RCR) : 36,500 BPSD
- Vacuum Residue (VR) : 30,420 BPSD
- Vacuum Gas Oil (VGO) : 3,380 BPSD

- Lube Surplus : 5,650 BPSD

4.3.5 Process Configuration

The proposed FCC Complex will be comprised of the main and auxiliary process units as follows.

- Vacuum Distillation Unit (VDU)
- Vacuum Residue Treater (VRT)
- Hydro-Desulfur Unit (HDS)
- Fluid Catalytic Cracking Unit (FCC)
- FCC Gasoline Hydrotreater (HT)
- LPG Hydrotreater
- Sulfur Recovery Unit (SRU)
- Gasification Unit

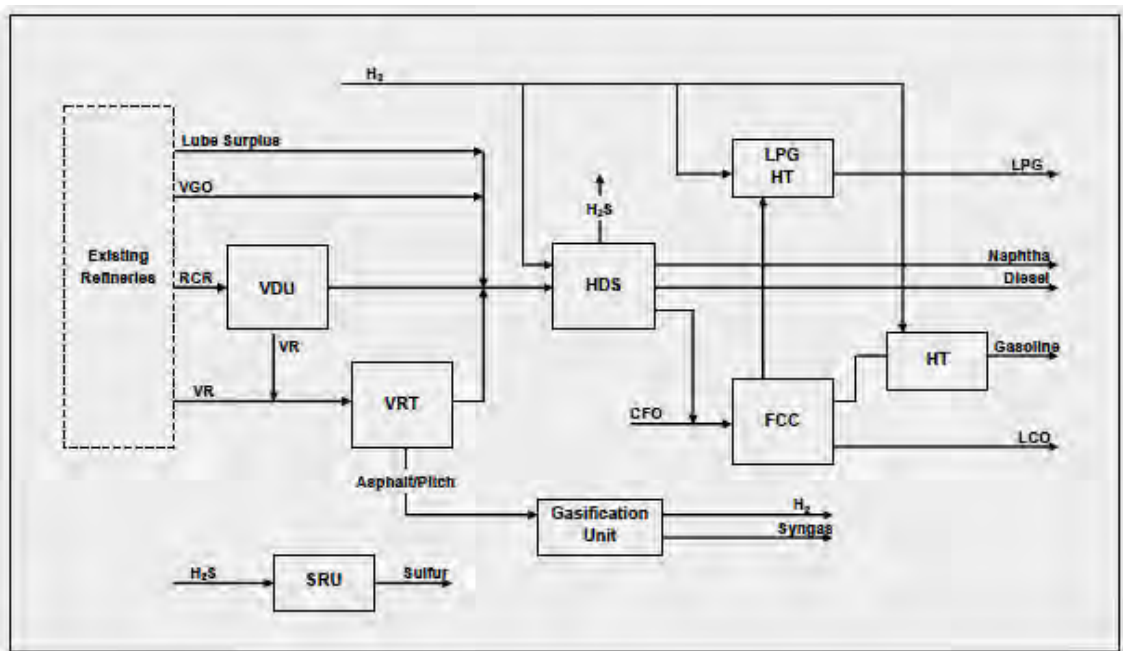


Figure 4.3.5 Process Configuration of FCC Complex

Reduced Crude (RCR), the main feed stock of the FCC Complex, is supplied from the Distillation Units of the existing refineries to the VDU. In addition, the other feed stocks such as VGO, lube surplus and VR are also supplied from the existing refineries to the system respectively.

VGO distilled by VDU is sent to HDS to eliminate the sulfur in VGO as H₂S by hydro-desulfurization reaction. VR drawn out from the bottom of VDU is fed to VRT for the maximum recovery of the lighter HC component similar to VGO from VR, and then the recovered oil is fed to HDS.

The HDS produces naphtha and diesel as products and the residue of HDS is fed to FCC. FCC produces FCC gasoline, LCO (FCC light cycle oil) and LPG. The FCC gasoline and LPG are run down to the storage tanks respectively after stabilization by hydrotreaters.

H₂S in the sour gas from HDS which contains high H₂S is sent to SRU. The SRU recovers the sulfur from H₂S and produces the molten sulfur as by-product.

On the other hand, the VRT produces asphalt or pitch in the process as by-products, which are less marketable in Iraq. The project proposes to introduce the Gasification Unit for conversion of the asphalt or pitch to hydrogen (H₂) and syngas. The H₂ can be used for the process of HDS and HT, whereas the syngas can be supplied to the optional in-house power generation plant in the refinery or to other consumers in the region, if available.

Two (2) optional processes for VRT are discussed for the maximum extraction of the feed stock for the FCC unit from VR in order to achieve the highest yield of gasoline and diesel. The options include:

- Case 1 Solvent extraction process: Solvent De-Asphalt Unit (SDA)
- Case 2 Thermal cracking process: Eureka process

4.3.6 Auxiliary and Utility Facilities

(1) Utility Supplies

The electric power necessary for operation of the new FCC Complex will be supplied from the existing power supply grid in the region. A new power receiving system and power distribution and control system for the respective facilities in the FCC Complex will be provided in the site. On the other hand, the construction of an in-house power generation plant utilizing the gas produced by the gasification process in the FCC Complex is proposed as alternative plan to achieve full self-power supply to the new facilities.

The FCC Complex will require an additional volume of industrial water to the existing water supply system. A new water intake station with a water transfer pipeline is included in the project to ensure that sufficient volume of water is available to the new facilities. The new water

intake station will be provided at the up stream point of the cooling water out fall of the Baiji Power Station located at north-east of the refinery. A capable water transfer pipeline will be laid from the water intake station to the refinery. The water transfer pipeline of approximately 7 km length will be laid in parallel with the existing domestic road routed in the northern area of the refinery.

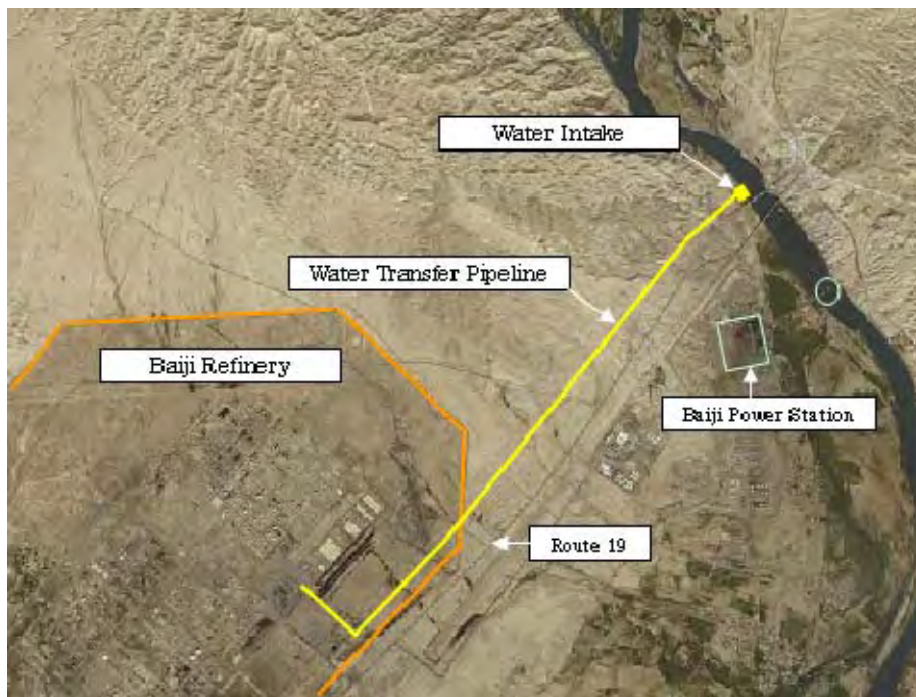


Figure 4.3.6 Water Supply System

In addition to power and water supplies, the project will also provide the other utility systems such as the fuel (oil and gas) system, steam system including steam generation and distribution system, instrument and plant air system, nitrogen (N₂) system, cooling water system, etc. necessary for operation of the FCC Complex.

(2) Auxiliary Facilities

The project includes the construction of various auxiliary facilities associated with the FCC Complex. The auxiliary facilities consist of the offsite facilities such as storage tanks for the intermediate products and product tanks, environmental protection facility including waste water treatment system, safety system including fire protection and fighting system, control and communication system, etc. and buildings such as control room, maintenance shops, warehouses, office buildings and others.

The interface systems between the new FCC Complex and the existing refinery, include the feed stock supply line from the existing refinery, the data and signal communication system, run-down pipeline for the products or intermediate products, etc.

In addition to the above, the modification of the related facilities such as the product tanks, blending system, loading facility, etc. in the existing refinery, which will be used as common facility for the operations of the Baiji Refinery are also included in the project.

4.3.7 Operation and control method

The operation of the FCC Complex will be integrated with the existing Baiji Refinery. The related offsite facilities i.e. storage tanks, blending system, loading system, etc. are utilized commonly upon necessary modification.

Process and operation of the FCC Complex will be secured by an independent computerized control system (e.g. Distributed Control System: DCS) equipped with necessary data communication with the existing Baiji Refinery.

4.3.8 Applicable laws, regulations, standards, etc.

The FCC Complex and other related facilities will be designed, constructed and operated properly in accordance with the following.

- Relevant laws, regulations, standards in Iraq
- Technical standards practically applied to the oil sector (i.e. API, SAME, ANSI, ASTM, NEC, ISA, NFPA, SSPC, NACE, etc.)
- International guidelines and practices for refinery

4.4 Facilities Construction

The construction of the FCC Complex will be carried out by an experienced international contractor selected by MOO/NRC, who is responsible for the detailed engineering, procurement of the materials and construction of the proposed FCC Complex.

The construction of the FCC Complex will commence after completion of the FEED stage. It is estimated that the construction of the whole FCC Complex including the related facilities completely will take at least about 40 months. Details of the practical execution scheme and schedule for the successful completion of the project have not been finalized yet for the time being. The project execution scheme including the phasing of the construction will be discussed

seriously in the subsequent phase according to the situation of the project such as operability of the entire refinery, technical capability of NRC for project management and operation, finance, market requirements, etc.

4.4.1 Material Procurement and Transportation

The majority of the equipment and materials required for construction of the FCC Complex will be procured from the manufacturers and vendors in the international market. The imported goods will be unloaded mainly at Umm Qasr port in Basrah province, in the south of Iraq and transported to the site through the road and railway networks available in the country. The other bulk materials such as gravel, sand, cement, and other raw materials which are readily available in Iraq will be furnished from the local markets.

The logistics plan including the methods and routes for the materials especially the heavy and large equipment such as process vessels, towers, etc. will be developed properly in the FEED phase according to the conditions of the roads leading to the destination and the availability of the equipment for transportation considering the situation of the regions that need to pass through.

4.4.2 Site Preparation

The project site of the FCC Complex has been prepared at the facilities area in the existing Baiji Refinery. Therefore, heavy soil works for site preparation are not required for installation of the new facilities. However, a new water supply system consisting of the water intake station and water transfer pipeline will be provided at the northern area of the refinery. The preparation of the right of way (ROW) will be made along the pipeline route.

Such civil works will be carried out by the local contractors in accordance with the specifications and procedures for construction.

4.4.3 Facilities Construction

The facilities construction includes various activities such as civil works, foundation works, installation of the equipment, erection and fabrication works, piping, cabling, painting and insulation works, etc. These activities except the water supply system will be carried out mainly at the project site in the Baiji Refinery. The construction will be carried out by a competent construction contractor with sufficient experience in the world. The contractor will mobilize the capable sub-contractors in Iraq or the neighboring countries and construction equipment.

The works will be made properly in accordance with the specifications and procedures of the design documents of the facilities under supervision of the contractor and NRC. The 3rd party inspector will be employed to ensure the quality of the equipment and materials as well as the workmanship of the construction.

4.4.4 Pre-commissioning

After the mechanical completion of the equipment and facility, the partial functional tests of the equipment and system will be made at respective facilities. The work will be carried out by the pre-commissioning group consisting of the contractor personnel in charge, manufacturer specialists with witness of NRC and the 3rd party inspector.

4.5 Facilities Operation and Maintenance

4.5.1 Commissioning

After completion of the construction of the FCC Complex, the project will proceed to the commissioning stage prior to operation. Special commissioning group will be organized consisting of the operators of the FCC Complex, maintenance personnel, specialists of the process licensors and equipment manufacturers, EPC contractor and other personnel related to the facilities.

4.5.2 Operation and Maintenance

The operation of the proposed FCC Complex will be directly linked to the operation of the existing Baiji Refinery. Therefore, after completion of the project, the upgraded Baiji Refinery will be provided with an integrated operation scheme for FCC Complex and the existing refineries. The applicable operation scheme including facilities maintenance will be made through considerations to the following issues.

- Operational options: integration of both facilities or separation (independence) from the existing refinery
- Current operation and maintenance scheme for Baiji Refinery
- New management requirements for operation and maintenance for FCC Complex
- Interaction and interface of operation between the existing refineries and FCC Complex (transfer of feedstock and products, operational data and signals, etc.)

- Technical requirements for operation and maintenance of FCC Complex
- Emergency responses and management (fire and explosion, injuries, etc.)

The functional organization for the operation and maintenance of the FCC Complex will be developed dedicatedly in the subsequent phase of the project prior to the operational phase.

4.5.3 Emergency

The initial emergency response of FCC Complex such as total or partial emergency shut-down (ESD) and blockage are executed by the command from the control room of the FCC Complex. The emergency response system such as fire fighting, toxic gas release and oil spill response for FCC Complex facility are applied as a branch system of the unified system of the entire Baiji refinery.

The operational response to the emergency situation of the process and the further response procedure for the secondary situation will be developed seriously in the subsequent phase of the project prior to commencement of the operation.

4.6 De-commissioning / Abandonment

The proposed FCC Complex will be designed properly based on the condition of 25 years of operational life. After the end of the plant's term or upon the termination of the facilities operation caused by the change of the refining business, the FCC Complex will be decommissioned/abandoned or re-organized properly. The scheme and method of decommissioning/abandonment will be developed suitably in accordance with the situations of the business and legal requirements during that time.

4.7 Project Organization

North Refineries Company (NRC) will establish the Project Office (PO) in the organization of the company, which is responsible for management for the project execution. The PO consists of the technical groups in charge of Onsite and Offsite facilities, HSE group, material procurement, quality assurance/quality control (QA/QC) group as well as administration group necessary for managing the project operation.

The technical groups are responsible for the technical aspects including engineering and design of the facilities and supervision of the performance of the contractors in FEED and EPC phases. The QA/QC group is responsible for the quality management for the deliverables/goods

furnished by the contractors and the workmanships of the contractors. The 3rd party inspectors will be employed for support of the QA/QC group.

The independent HSE group will be provided in the PO for implementation of the HSE and social considerations of the project including a preparation of the EIA and the coordination with the authorities related to the environmental protection and social issues. OP will allocate the sufficient resources including the competent personnel and budget necessary for achieving the roles and responsibilities of the group.

The PO is headed by the Project Manager with assistance of an assistant PM and a coordinator, who is fully responsible for the management of the entire project execution and performance including schedule and budget for the project.

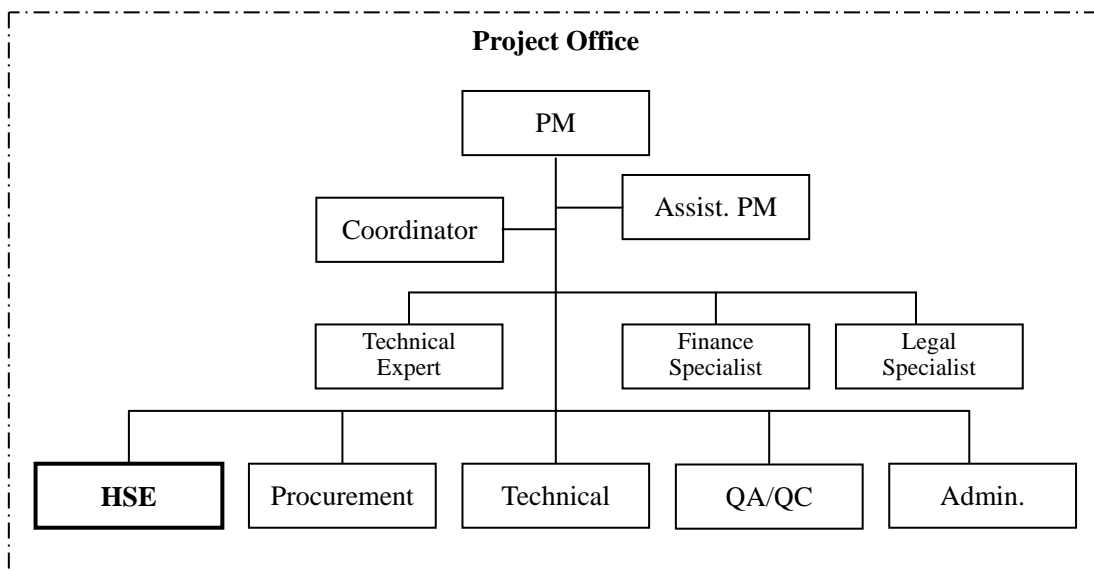


Figure 4.7 Project Organization

Further, NRC will employ a qualified and experienced consulting firm for project management consultancy (PMC) during the FEED phase and EPC phase respectively for the necessary support and assistance of the PO to ensure successful completion of the project as planned.

4.8 Technical Training

The proposed FCC Complex will be comprised of new technical elements such as refining processes and equipment, control system and operating procedures, which are not adopted in the Iraqi refineries yet. The success of the operations of the FCC Complex could be achieved by the technically competent operational and maintenance personnel and introduction of the proper

management procedures for the operations in accordance with the international practices for the same industrial sector.

The project will provide a comprehensive technical training program in the North Refineries Company. The technical training program aims to enhance the engineering, operational and maintenance technology of the personnel to be involved in the operations of the FCC Complex. The program is implemented continuously throughout the respective phases of the project including the engineering (FEED), construction and commissioning and operation phases.

5 Project Alternatives

5.1 No Project Option

A serious consideration has been given to the necessity and validity of the project. The proposed upgrading project for Baiji Refinery is situated on one of the major development project of the refinery sector in Iraq and it is aiming to be a successful achievement of the new national development strategy through the possible effects derived from the implementation of the project. The project will contribute for:

- Improvement of supply-demand balance of the oil products in the region according to the national development strategy,
- Promotion of modernization of refineries in Iraq,
- Environmental effects by supplying high quality (low sulfur) vehicle fuels, and
- Social and economic effects by increased employment opportunities in the region and reduction of national expenditure for importation of the vehicle fuels for filling up of the current supply-demand gaps.

No such effects of the project are expected, if “no project option” is selected.

5.2 Construction of New Refinery

Ministry of Oil (MOO) is also planning to build new refinery plants according to the national development strategy for increasing the refining capacity in the next decade. For the construction of a new refinery, it is expected that a longer period of time is needed and also require a much larger amount of budget for the execution of the project because of the larger extents of the facilities to be constructed. Furthermore, the new refinery construction project will potentially cause various impacts on the environment and the local communities in the project region due to emissions of the pollutions by the construction and operation activities. In addition, land acquisition for the project site is likewise an issue that needs to be settled when new refinery is to be constructed.

Meanwhile, the upgrading project of the existing Baiji refinery could very well achieve the targets of the national development strategy within a shorter period of time and with lower budget amount, because the related existing processing facility could be utilized effectively and the project site is already available in the existing refinery boundary. Also with the upgrading

option, it is expected that the additional environmental and social impacts of the project will be minimized.

This is the main reason for the selection of upgrading project instead of the option of new construction.

5.3 Process Selection

The concept for optimum process configuration of the FCC Complex is to prioritize the following operational aspects:

- Highest yields of gasoline and diesel for complying with the demands
- Minimum by-products i.e. low marketable heavy fuel oil, asphalt, coke/pitch
- Low construction and operational costs (CAPEX/OPEX)
- High operability and maintainability
- Lowest environmental impacts and energy consumption

For process optimization of the FCC Complex, a comprehensive case study on the four (4) optional processes was made seriously. The optional processes include:

- SDA (Solvent De-Asphalt process) Scheme
- Eureka (Thermal cracking process) Scheme
- Flexicoker (Hydro-Conversion) Scheme
- Delayed Coker (Thermal cracking) Scheme: for reference

According to the outcome of discussions for the different options, SDA and Eureka schemes are selected as the applicable processes due to higher light products yield than Flexicoker scheme. The relative comparison for the advantages of the optional schemes is outlined below.

Table 5.3 Process Comparison

	SDA	Eureka	Flexicoker	Delayed Coker
Product Yield	H	M	M	M
By-products	H	H	M	H
Costs (CAPEX/OPEX)	M/M	H/H	M/-	H/M
Environmental Impacts / Energy Consumption ^(Note)	H	H	M	M

H: High advantage, M: Middle advantage, L: Low advantage

The optimum process for the FCC Complex will be selected properly among SDA and Eureka by MOO/NRC according to the findings of further detailed study including the comparison of the potential environmental impact as well as the energy consumption in the subsequent FEED phase.

(Note) The environmental loads of the operation of the refinery on the surrounding area are defined by the volumes of the waste substances such as gases, wastewater discharged from the facilities, which are generally proportional to the consumption of the utility (power, fuels, water, etc.) to say the energy.

6 Environmental and Social Baseline

6.1 Project Location

Baiji Refinery is located in Baiji City, the third largest city of Salahuddin province, at the central north of Iraq. Baiji City stands on the west basin plain of the Tigris River, about 250 km north of Baghdad with a population of about 200,000.

One of the major national roads leading north from Baghdad to Mosul, Route 1, passes Baiji. A main road running northeast to Kirkuk and southwest to Hadsitha, Route 19, also crosses Baiji. Two of Iraq's main national railways; Baghdad-Mosul-Dahuk (north-south line) and Kirkuk-Baiji-Haditha (east-west line) cross at Baiji City. Baiji Refinery is located at the junction of these two roads, as shown in Figure 6.1-1, that it is strategically good for transportation of the oil products and materials/equipment for construction of FCC complex.

Figure 6.1-2 shows a satellite image map around Baiji Refinery. Baiji Refinery is located about three kilometers north of the old urban area of Baiji city, adjoining a new residential area on the south. It is about three kilometers away from the west bank of the Tigris: irrigated fields spread out along the bank of the river.

6.2 Physical Environment

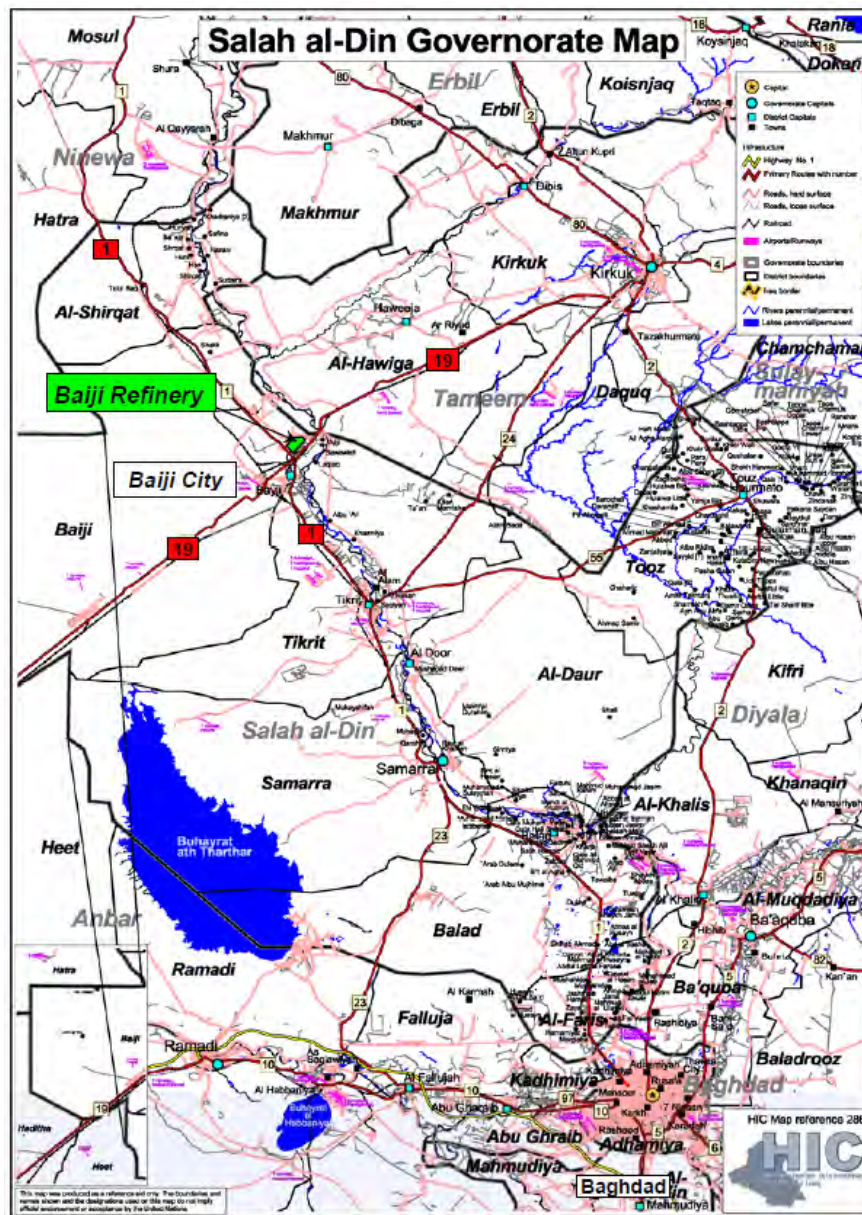
6.2.1 Geographical Features

Iraq can be divided into four geographical zones as described below (refer to Figure 6.2-1):

- a. **Western/Southern Desert plateau:** Approximately 40 percent of Iraqi territory. A broad stony plain with scattered stretches of sand is lying west and southwest of the Euphrates River and sparsely inhabited by pastoral nomads. A network of seasonal watercourses (or wadis) runs from the border to the Euphrates River.
- b. **Northeastern highlands:** Covering approximately 20 percent of Iraqi territory. This region extends south of a line between Mosul to Kirkuk towards the borders to Turkey and Iran, where mountain ranges reach up to 3,600 m in attitude.
- c. **Uplands region:** About 10 percent of Iraq. A transitional area between the highlands and the desert plateau, located between the Tigris north of Samara and the Euphrates north of Hit, and forming part of a larger natural area that extends into Syria and Turkey. Much of this zone may be classified as desert because watercourses flow in deeply cut valleys, making irrigation far more difficult than in the alluvial plain.

- d. **Alluvial plain:** Approximately 30 percent of Iraq. Formed by the combined deltas of the Tigris and Euphrates Rivers. This region begins north of Baghdad and extends to the Persian Gulf. The once-extensive wetlands of the region have been decimated by damming and diversion of the Euphrates in Turkey and Syria, and by large-scale drainage works.

Baiji city is located in the central north part of Iraq with altitude of 140 meter above sea level, which is classified in the uplands region as shown in Figure 6.2-1.



Source: United Nations Assistance Mission for Iraq

Figure 6.1-1 Map of Salahuddin Province

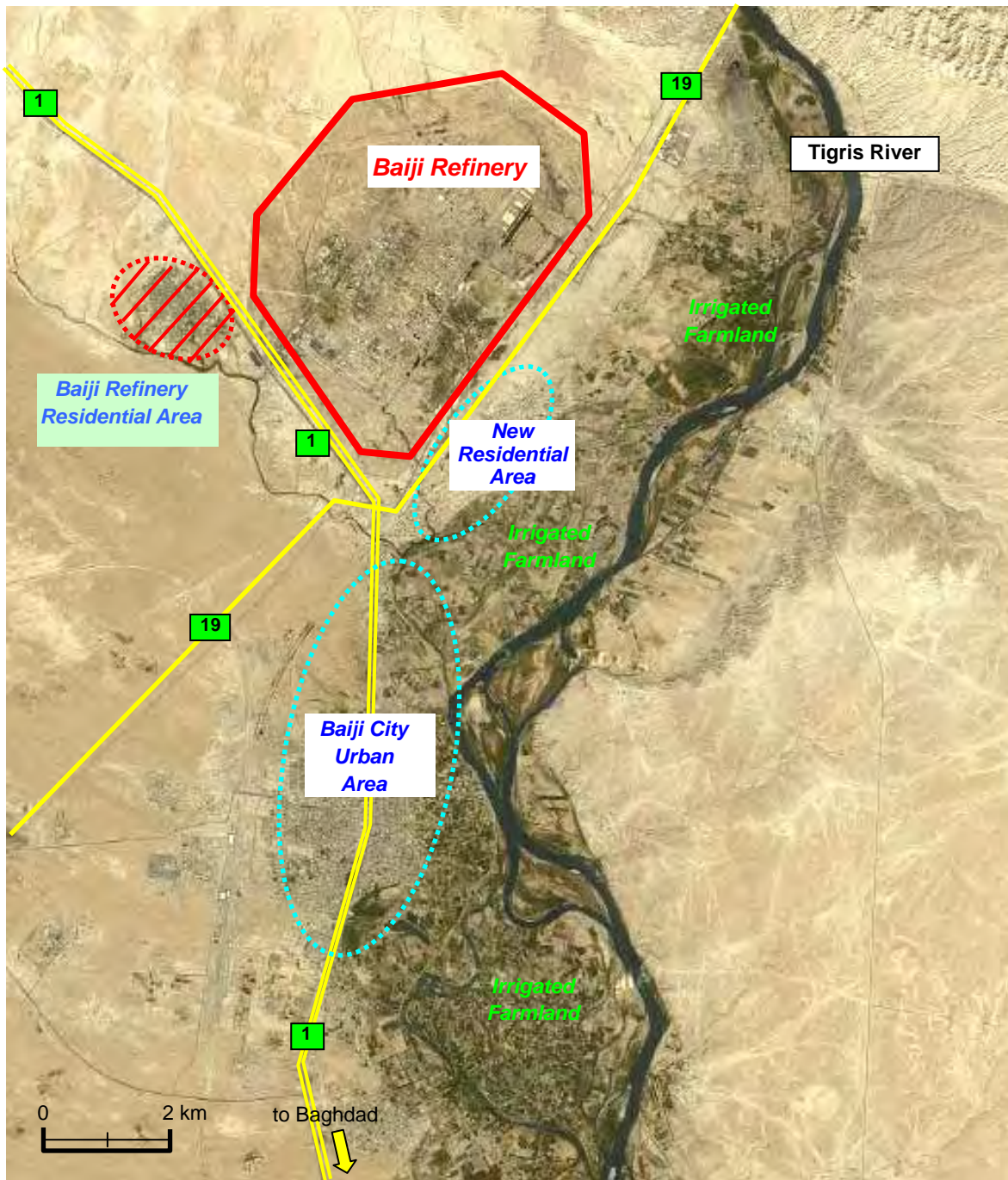
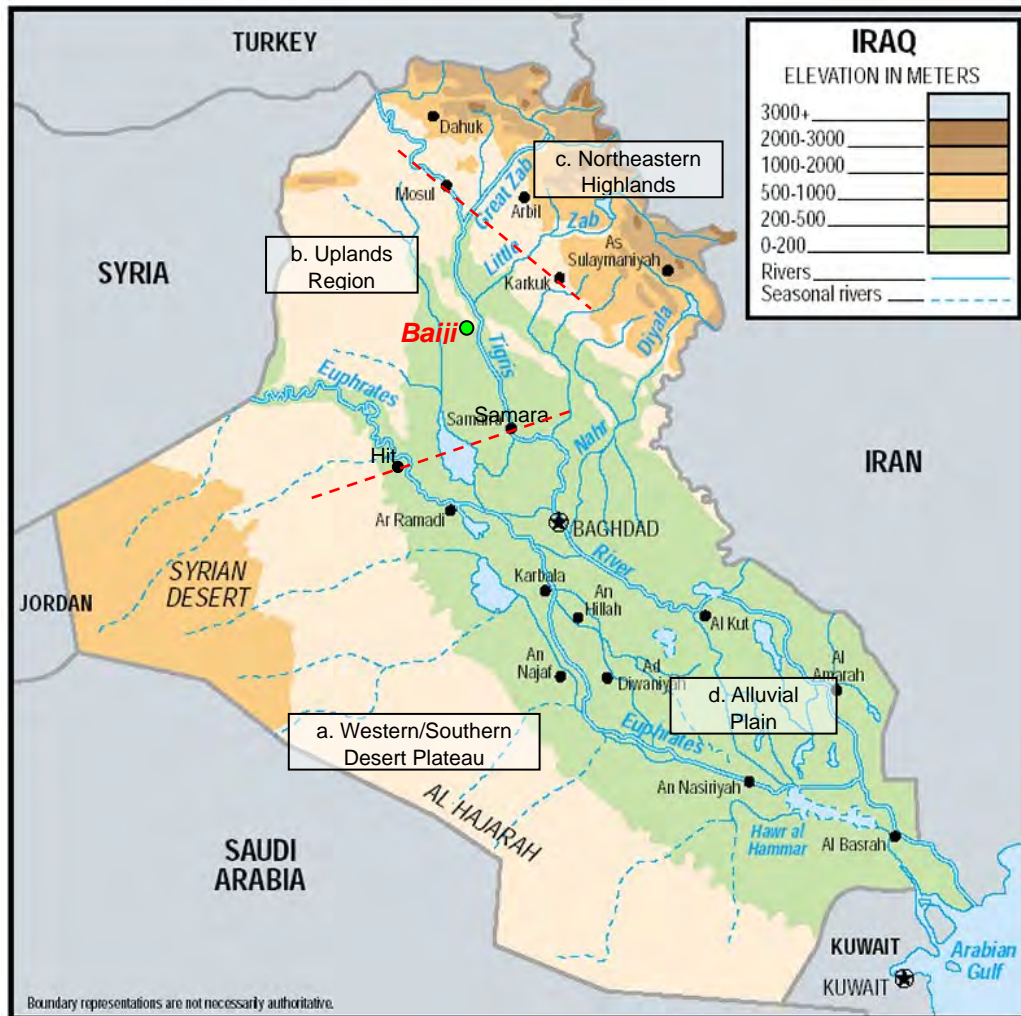


Figure 6.1-2 Satellite Map of Baiji Refinery



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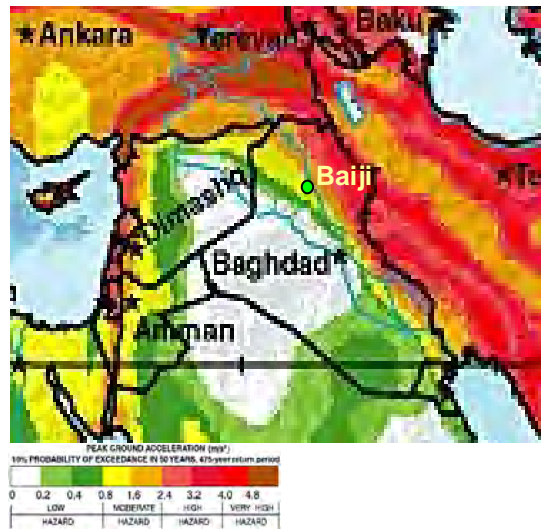
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Figure 6.2-1 Geographical Regions in Iraq

6.2.2 Earthquake

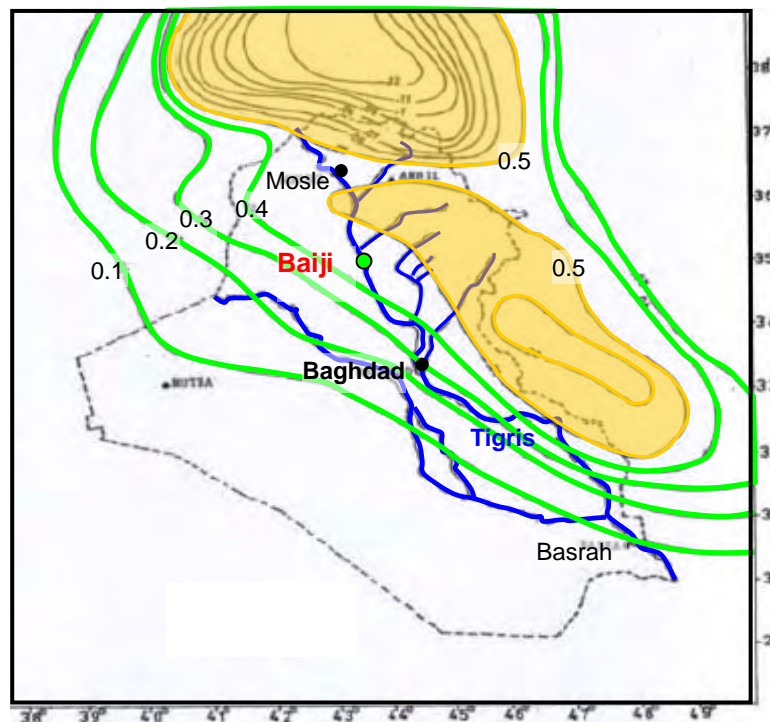
Figures 6.2-2 and 6.2-3 represent the peak ground acceleration in Iraq. The regions east of the Tigris River have a high seismic occurrence where an earthquake with magnitude $M \geq 4.0$ occurs once every two to five years. The region between the Tigris and Euphrates Rivers experiences a low rate of occurrence between five to ten years. The south and southwestern regions have a low earthquake occurrence for durations of more than ten years.

The peak ground acceleration in 100 years for Baiji region is around 0.5 m/s^2 , which corresponds to low seismic hazard.



Source: <http://geology.about.com/library/bl/maps/blmiddleeast.htm>

Figure 6.2.2-1 Peak Ground Acceleration (m/s²)
 - 10% Probability of Exceedance in 50 years



Source: Earthquake Hazards Considerations for Iraq, Sahil .A. Alsinawi¹ and Zia O. Al-Qasrani*

Figure 6.2.2-2 Seismic ios-Acceleration Map with Design Period of 100 Years

6.2.3 Climate

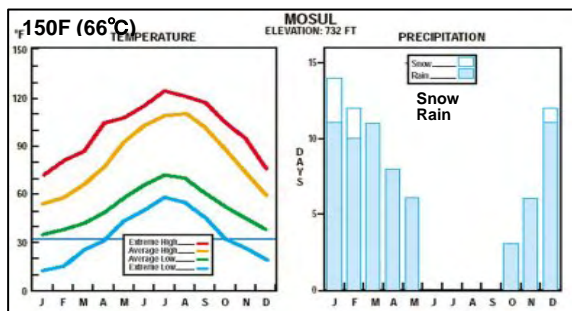
The climate in Iraq is mainly of the continental, subtropical semi-arid type, with the north and northeastern mountainous regions having a Mediterranean climate. Table 6.2-1 shows the annual temperature and precipitation for each of four geographical zones. Rainfall is very seasonal and occurs mainly between December to February, except in the north and north-east region where the rainy season is longer, from November to April.

According to the design condition for Baiji Refinery, ambient temperature in the project site is; 55 for 60 days per year, 40 to 45 for 75 days per year, and -1 to 35 for rest of the year. Annual precipitation is; 5 to 10 days for thunder storm, 10 days for heavy rain and 20 days for normal to low rain. It is dust/sand environment during dry season; 30 days for sand storm and 35 days for dust storm.

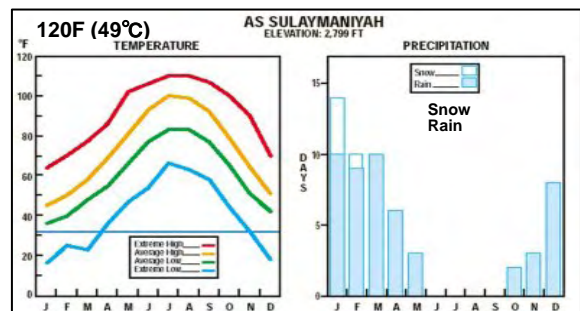
Table 6.2.3 Annual Temperature and Precipitation in Iraq

Source: <http://www.globalsecurity.org/military/world/iraq/climate.htm>

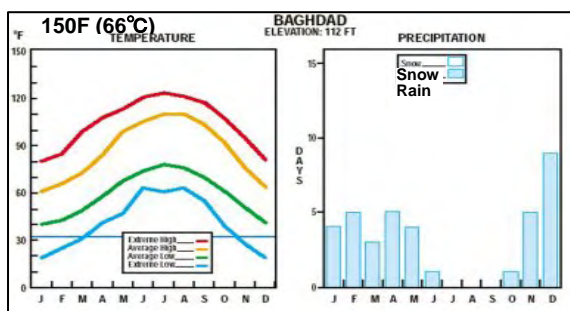
Region	Winter		Summer		Extremes	
	Min	Max	Min	Max	Min	Max
a. Desert plateau	9°	16°	20°	40°	-14°	49°
b. Upland Region	3°	13°	25°	40°	-12°	49°
c. Highlands Region	-4°	5°	15°	25°	-30°	42°
d. Alluvial Delta	4°	18°	25°	40°	-7°	51°



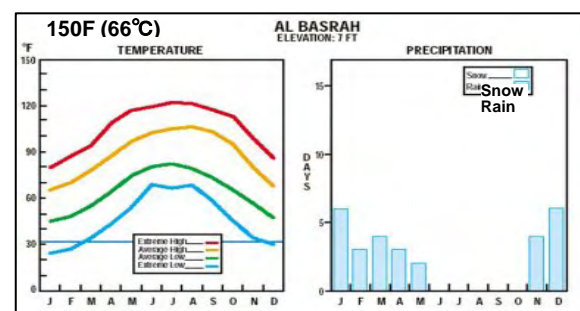
b. Mosul (Upland)
 Elevation: 732 ft



c. As Sulaymanyah (Highland)
 Elevation: 2,799 ft



d. Baghdad (Alluvial Delta)
 Elevation: 112 ft



d. Al Basrah (Alluvial Delta)
 Elevation: 7 ft

6.2.4 Atmospheric Conditions (air quality and emission)

Iraq is suffering from unhealthy air quality and impact to land such as:

- The unregulated use of Power Generators due to the insufficient output of electricity
- Lack of Car Emission regulations and modern car inspection techniques.
- Trash burning (Due to inadequate trash collection) & Tire burning
- Tree cutting/burning
- Lack of Green Belt and Parks in and around urban areas
- Lack of standards and unregulated construction practices for buildings, roads, and facilities

The air quality at the monitoring point in the Baiji Refinery is show below.

Table 6.2.4 Air Quality in the Baiji Refinery (2009)

	CO	CO ₂	NO ₂	SO ₂
Monitoring Data	0.539 – 0.886	764 - 1152	0.010 – 0.015	0.130 – 0.39
Iraqi Standard	35*	-	0.04*	0.2*
IFC Guideline ^{Note}	-	-	31*	15.5*

Source : NRC 2009

* 1hr average, ** 24hr average

Note: converted to ppm on the assumption of dry air

6.2.5 Water Quality of Tigris River

Both the Tigris and the Euphrates are trans-boundary rivers, originating in Turkey. Before their confluence, the Euphrates flows for about 1,000 km and the Tigris for about 1,300 km within the territory of Iraq. The area of the Tigris River Basin in Iraq is 253,000 km², which is 54 percent of the total river basin area. The average annual runoff is estimated at 21.33 km³ as it enters Iraq.

The present quality of water in the Tigris near the Syrian border is presumably good, including the water originating in both Iraq and Turkey. Water quality degrades downstream, with major pollution inflows from urban areas such as Baghdad due to poor infrastructure for wastewater treatment. The water quality of the Euphrates entering Iraq is less than that of the Tigris, as it is currently affected by the return flow from irrigation projects in Turkey and Syria and is expected to get worse as more lands come under irrigation. The quality of water in both the Euphrates and Tigris is further degraded by return flows from land irrigated in Iraq as well as

urban pollution. The amount and quality of water entering southern Iraq from Iranian territory is largely unknown, although it is clear that flows are impacted by irrigation return flow originating in Iran.

The deterioration of water quality and the heavy pollution from many sources are becoming serious threats to Iraq. One problem is the lack of any effective water monitoring network so that it is difficult to take measures to address water quality and pollution as it is impossible to identify the causes. Hence, the rehabilitation and reconstruction of the water monitoring network have become an urgent matter that need to be resolve to ensure water security.

The Mesopotamian Marshlands in the farthest downstream part of the Tigris and Euphrates Basin have been seriously damaged during the last two decades. Dewatering the marshland areas to foster agricultural production as well as to divert waters away from the marshes for political reasons has caused an adverse impact on the ecosystem and the indigenous populations. The historical marsh area of 17,000 km² has now shrunk to about 3,000 km² after the construction of a number of dams upstream. The potential success of recent restoration efforts depends primarily on the availability of sufficient quantities of satisfactory quality water to the marshland areas.

The quantity and quality of water entering the Gulf is also an issue to be addressed since fisheries are an important food source for the region. Other environmental issues to be taken into account are the impact of water management and changed flow regimes on migrating fishes and terrestrial species and on the viability of riverine and floodplain ecosystems throughout the Tigris and Euphrates basins.

Table 6.2.5 Water Quality of Tigris River (Baiji) 2008

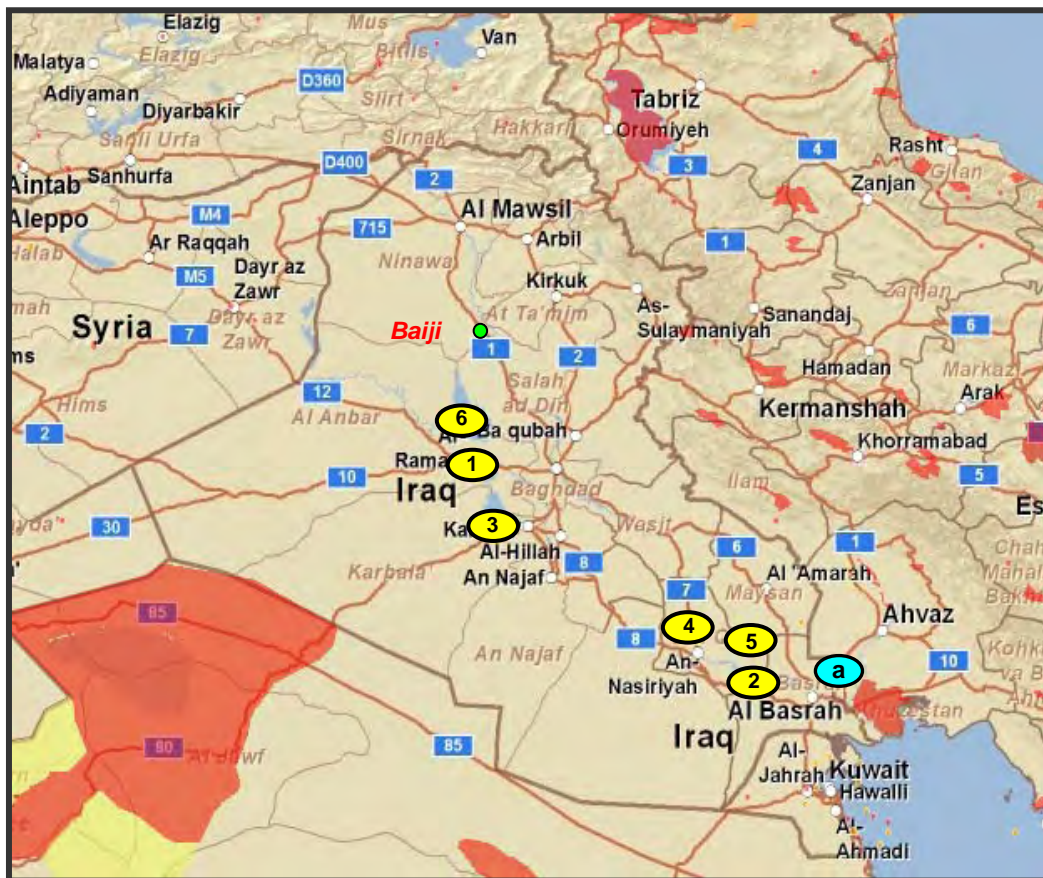
		Iraqi Standard	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Elec. Conductivity	Us/cm	-	338	325	330	343	375	390	423	413	406	432	360	370
pH	-	6.5-8.5	8.0	8.0	8.0	8.0	7.95	8.0	7.95	7.9	7.9	7.9	8.0	8.0
Turbidity	NTU	-	140	55	70	50	50	45	44	30	30	27	40	38
M-Alkaline	ppm	-	160	153	150	150	145	145	150	142	140	140	142	145
T-Hardness	ppm	-	230	220	210	215	207.5	210	217	215	215	217	210	210
Ca-Hardness	ppm	-	158	154	150	150	140	140	145	142.5	140	145	145	142
Chloride	ppm	200	23	20	21	20	20	19	21	19.8	20.6	22	19	20
Sulphate SO ₄	ppm	200	62	62	60	62	52	66	68	82	58	56	52	48
Silica SiO ₂	ppm	-	4.9	4.8	4.9	5.1	4.75	4.6	5.2	4.85	4.65	5.25	4.3	4.4
Total Iron	ppm	0.3	1.16	0.8	0.76	0.7	0.58	0.75	0.8	0.65	0.7	0.66	0.65	0.68
TDS	ppm	-	237	228	231	240	263	273	296	290	285	302	266	259

Source : NRC EIA 2009

The water quality monitoring records of Tigris River at the existing water intake station for the Baiji Refinery are shown above.

6.3 Ecological Environment

6.3.1 Protected Areas



Source: <http://www.wdpa.org/WDPAMapFlex.aspx>

National Protected Area Ramsar Wetland Site

	Site Name	Total Area, ha
1	Habbaniya lake	-
2	Hor al Hammar marshes	270,000
3	Hor Suweicha wetland	30,000
4	Nasiriya marshes	-
5	Shatra marshes	-
6	Wadi Tharthar lake and marshes	320,000
a	Ramsar - Hawizeh Marsh area	137,700

Figure 6.3.1-1 Protected Areas and Ramsar Site in Iraq

The northern Gulf Region (including Kuwait, Iraq, eastern Saudi Arabia and western Iran) is especially important as part of the intercontinental flyways used by huge numbers of birds, and a great variety of species, moving between Africa and Eurasia.

There are several initiatives to establish national protected areas and create a network throughout the Iraq.

(1) National Protected Areas

The World Database on Protected Areas (WDPA), produced by the UNEP-World Conservation Monitoring Center (WCMC) and the IUCN-World Commission on Protected Areas, lists six protected areas in Iraq, as shown in Figure 6.3.1-1. The Wadi Tharthar lake and marshes, the nearest protected area, is located at the area more than 50 km south-west from Baiji.

(2) Ramsar Wetland Site

The Hawizeh Marsh area in Basra, Amara, covering approximately 137,700 hectares, was designated a Wetland of International Importance in October 2007. It is a complex of marshes that straddle the Iraq and Iran borders, which located at more than 500 km south-east from Baiji as shown in Figure 6.3.1-1.

The Hawizeh Marsh provides habitat and/or nesting place for fish and birds as shown in Figure 6.3.1-2. It also supports many local people through fishery or agricultural production in the grasslands.



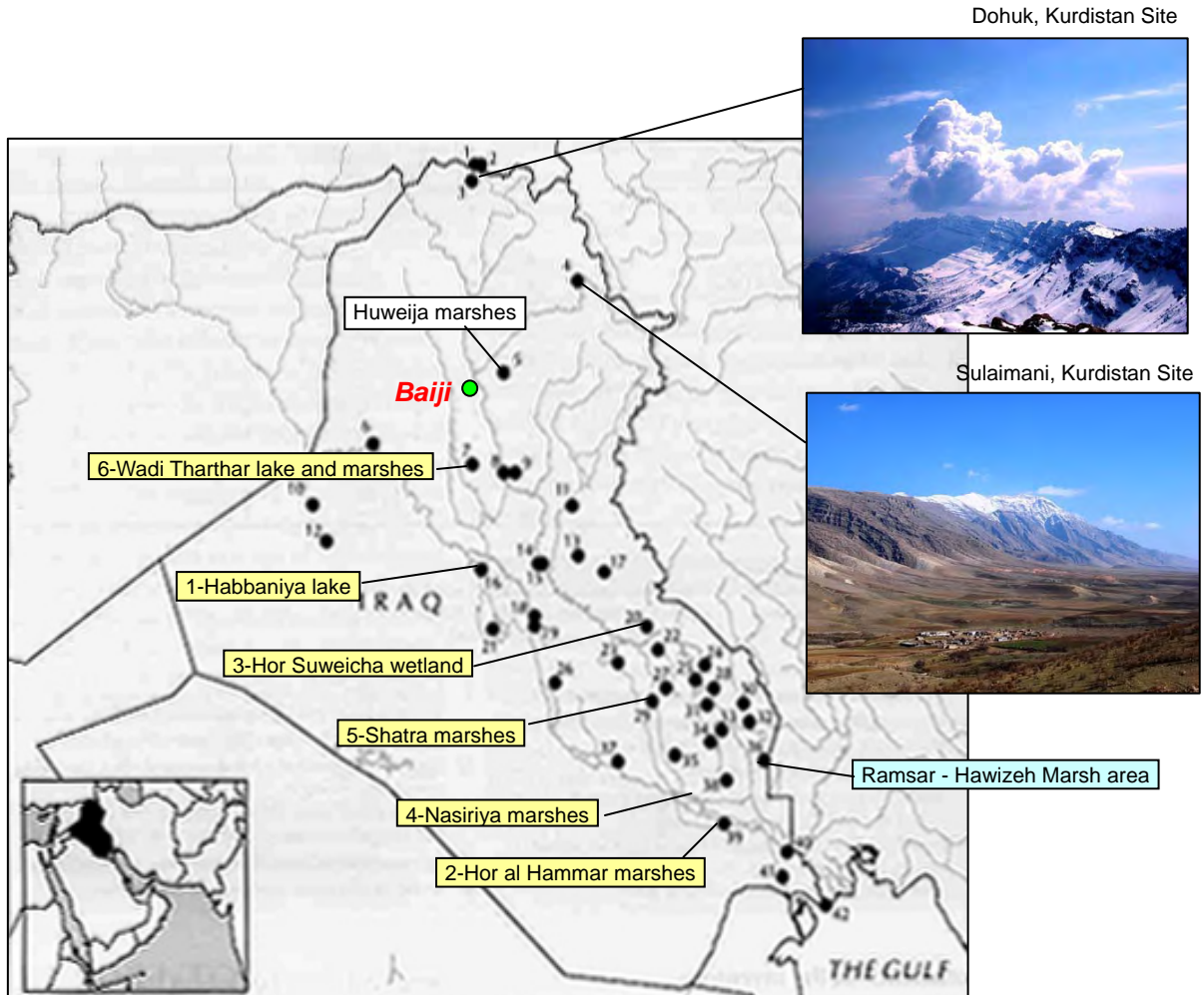
(a) Marshes extending into an open water area (b) Iraq Babbler (c) Waders on the marsh

Source: Management Plan for the Hawizeh Marsh Ramsar Site, Iraq

Figure 6.3.1-2 Hawizeh Marsh Ramsar Site

6.3.2 Biodiversity

(1) Key Biodiversity Area Program (KBA)



Central Marshes



Hor al Hammar Marshes

Figure 6.3.2-1 Map of Important Bird Areas (IBAs)

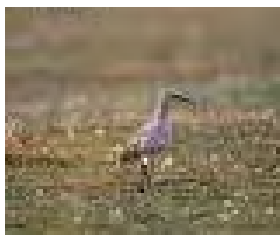
Iraq has a unique biodiversity features, especially in the marshes of Mesopotamia, however, significant environmental degradation has occurred in the recent years. Nature Iraq, Iraqi non-governmental organization, was established to protect, restore, and preserve Iraq's natural environment and the rich cultural heritage.

Nature Iraq has been conducting comprehensive biological surveys throughout Iraq under the project called **Key Biodiversity Areas Program (KBA)** since 2004, in association with Iraqi Ministry of Environment and universities. KBAs were selected based on the Important Bird Areas (IBAs) sites of high biological diversity identified by BirdLife International and Wetlands International as indicated in Figure 6.3.2-1. Main activities of the KBAs are:

- to create a network of National Parks and protected areas throughout Iraq (e.g. Mesopotamian Marshes in southern Iraq, Kurdistan, Northern Iraq and Central and Western Iraq).
- to prevent unregulated hunting
- to regulate trade in endangered species
- to control the development activities with effective Environmental Impact Assessments process

The Huweija Marsh, the nearest KBA, is located at approximately 40 km east from Baiji.

(2) Endangered Species



Numenius tenuirostris
(Slender-billed Curlew)



Vanellus gregarius
(Sociable Lapwing)



Geronticus eremite
(Northern Bald Ibis)

Figure 6.3.2-2 Endangered birds

Following animals which originally range in Iraq are listed as extinct, critically endangered, or endangered species in the IUCN Red List of 2008, however, their detailed habitat or distributions are not fully understood. Currently comprehensive biological surveys throughout Iraq are proceeding by Nature Iraq in conjunction with UNEP and BirdLife International as described in above article (1).

Status: Extinct

- *Gazella saudiya* (Saudi Gazelle)

Status: Critically Endangered

- *Geronticus eremita* (Northern Bald Ibis) – possibly extinct in Iraq
- *Numenius tenuirostris* (Slender-billed Curlew)
- *Okamejei pita* (Pita Skate)
- *Vanellus gregarius* (Sociable Lapwing)

Status: Endangered

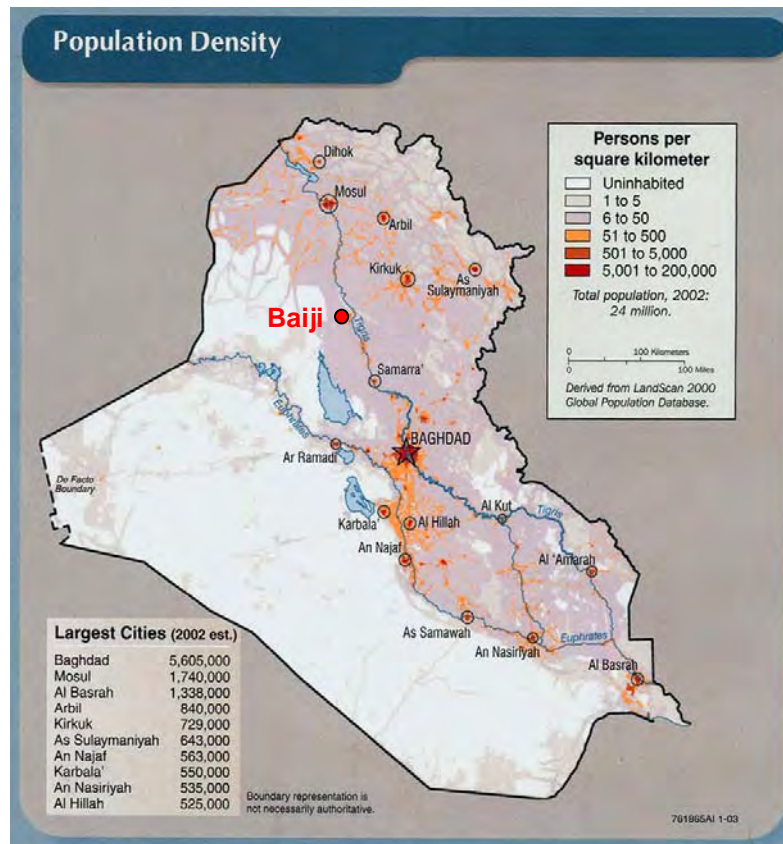
- *Branta ruficollis* (Red-breasted Goose)
- *Dama mesopotamica* (Persian Fallow Deer)
- *Equus hemionus* (Asiatic Wild Ass)
- *Falco cherrug* (Saker Falcon)
- *Neophron percnopterus* (Egyptian Vulture)
- *Nesokia bunnii* (Bunn's Short-tailed Bandicoot Rat)
- *Oryx leucoryx* (Arabian Oryx)
- *Oxyura leucocephala* (White-headed Duck)
- *Rafetus euphraticus* (Euphrates Softshell Turtle)
- *Sphyrna lewini* (Scalloped Hammerhead)
- *Sphyrna mokarran* (Squat-headed Hammerhead Shark)

6.4 Socio-economic Conditions

6.4.1 Population and livelihood in the communities

Salahuddin province is abundant in agricultural resources, and has about 1.1 million populations, of which about 616 thousand are capable labor forces. Refer to Figure 6.4.1-1.

The area of the province is about 29,000 square kilometers and surrounded by other Iraqi provinces. The capital city is Tikrit. The national roads and railways are running through the province. The Tigris River is also running through the center of the province.



Source: http://www.lib.utexas.edu/maps/middle_east_and_asia/iraq_pop_2003.jpg

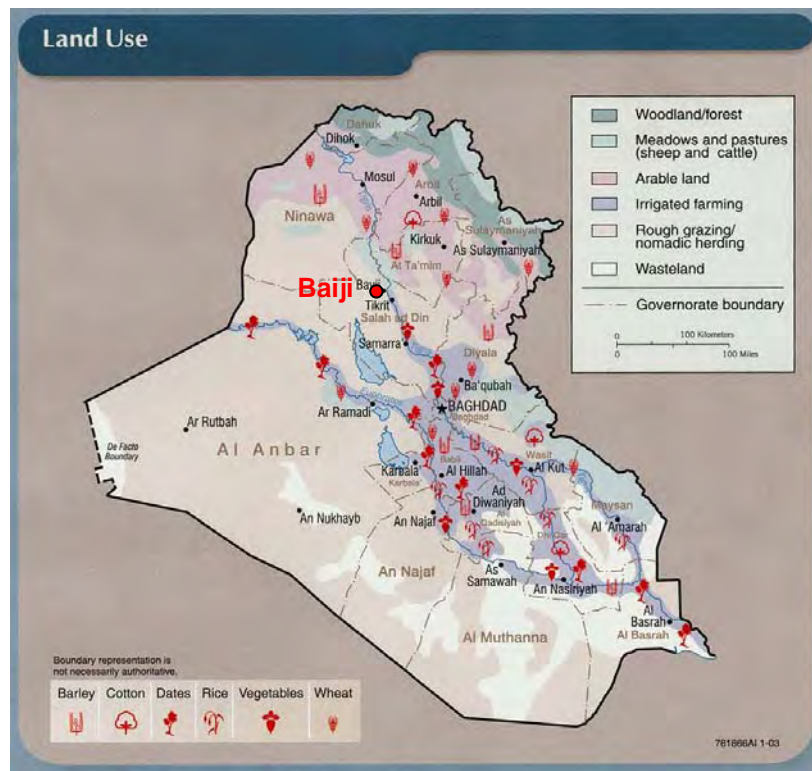
Figure 6.4.1-1 Population Density in Iraq

6.4.2 Economic activities in the region (industries, agriculture, livestock, etc.)

The main industry of the province is agriculture (livestock) and oil refining. 44% of the workforce in the province is employed in the agricultural sector, which is the highest percentage among all 18 provinces. In the province, a huge number of grape vines, apple trees, and citrus trees are under cultivation.

In addition to Baiji refinery, Baiji has large power plant and urea fertilizer plant. Further concentration of petrochemical industry is expected around Baiji city using these infrastructures and the existing plants.

Also tourism has a potential in the province since there are many ancient monuments with transportation convenience like Samara. Samara is one of Iraq's major historic places. Its ruins extend for hundred of square kilometers along the Tigris River. The province contains several important Muslim shrines and mosques.



http://www.lib.utexas.edu/maps/middle_east_and_asia/iraq_land_use_2003.jpg

Figure 6.4.2-1 Land Use in Iraq

6.4.3 Infrastructures

According to the Ministry of Oil (MOO) information, conditions of the infrastructure of project region are described as follows:

(1) Roads and railways

Networks of the main roads and railways of Iraq are shown in Figures 6.4.3-1. One of the main roads leading to north from Baghdad heads to Samara and Tikrit, and also passing Baiji on the way to Mosul. From Tikrit, a primary road heads northeast to Kirkuk. A main road also crosses the province at Baiji, running northeast to Kirkuk and southwest to Haditha in Al Anbar province and on the Al-Qaim border crossing with Syria.

Major north-south rail line in Iraq passes through the province with service from Baghdad to Mosul via Tikrit. Baiji is located on the main road from Baghdad to Mosul. The Baiji location is good for transportation of the oil products and materials/equipment for construction of FCC complex. Also, Baiji is the junction of the national railway.

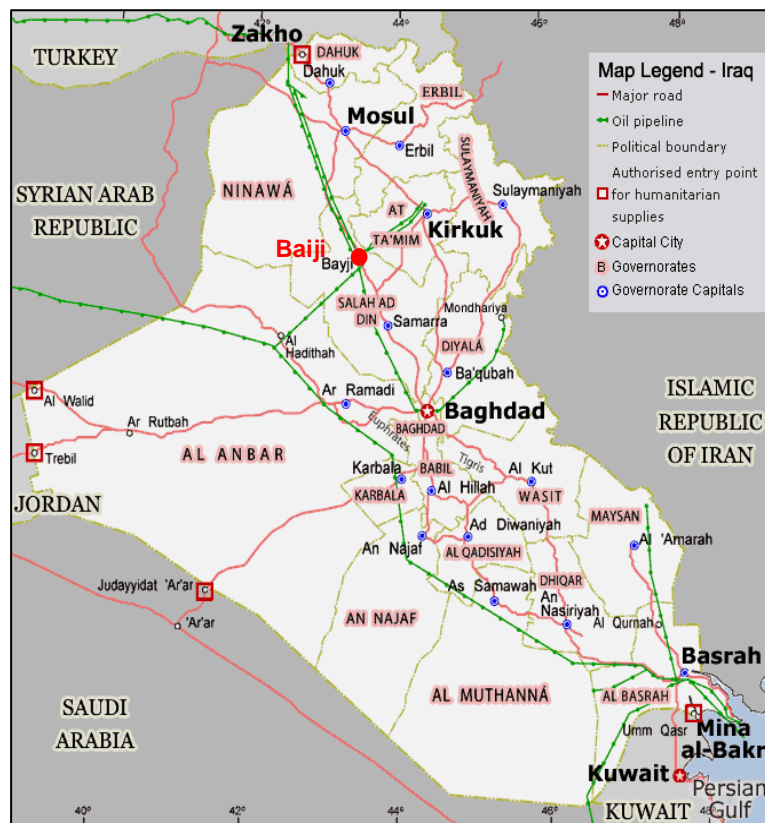


Figure 6.4.3-1 Roads Network in Iraq



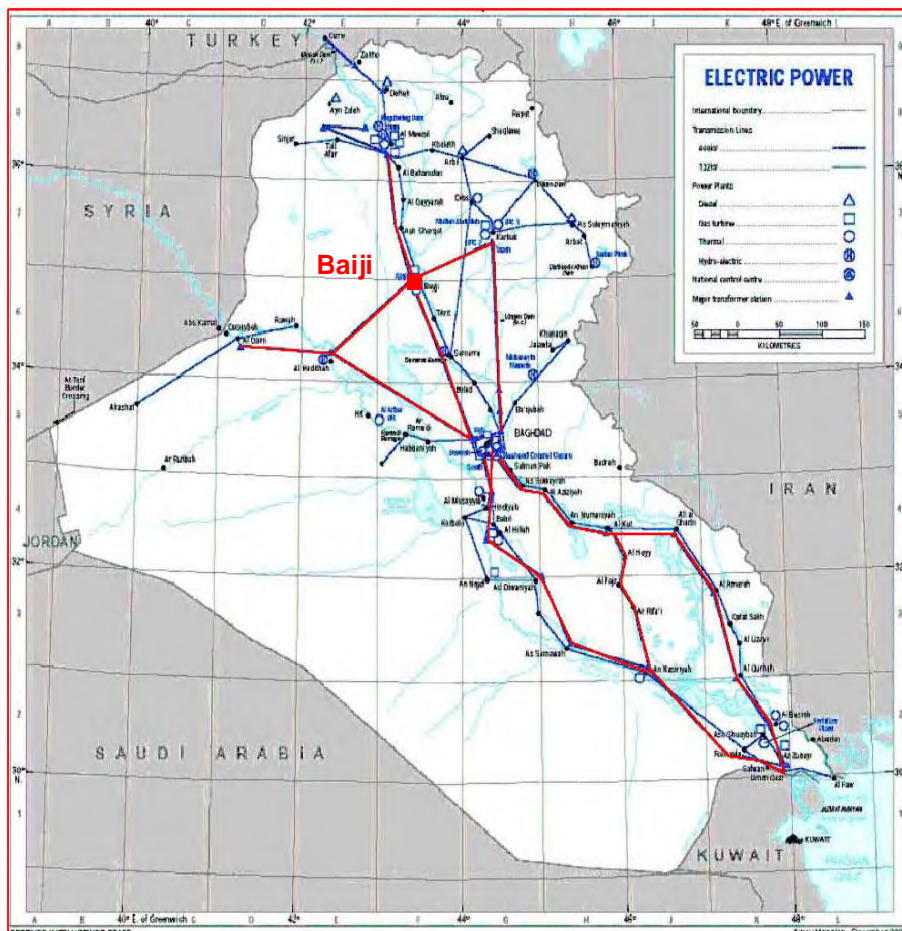
Figure 6.4.3-2 Railways Network in Iraq

(2) Industrial Water Supply

The water requirement for Baiji Refinery is taken from the Tigris River and waste water is discharged in the lower course of the river. Construction of new facilities for water intake which will enable water intake required for the whole Baiji Refinery including the proposed FCC is anticipated.

(3) Electricity

The capacity of electricity currently supplied by Ministry of Electricity (MOE) to Baiji Refinery is 85 MW, but which can be increased up to 110 MW. The power system network of Iraq is shown in Figure 6.4.3-2.



Source: The Ministry of Oil

Figure 6.4.3-3 Power System Network of Iraq

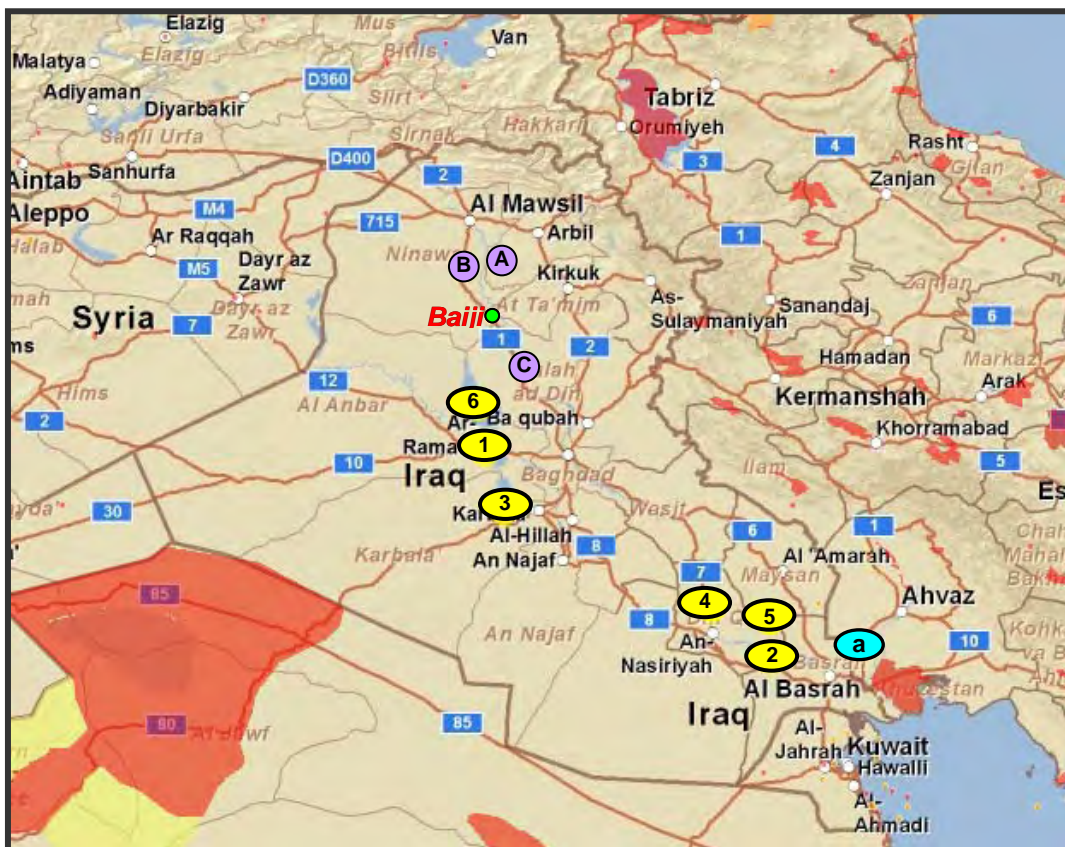
The backbone power system of Iraq consists of 400 kV and 132 kV transmission line network, with the 400 kV transmission line arranged forming a loop power system. As this 400 kV transmission line is in the form of a loop, the supply reliability is higher at the failure of the power system, compared to that of radial loop system.

6.4.4 Historical and Cultural Heritages

Iraq has been home of continuous successive civilization since the 6th millennium BC. The ancient Mesopotamian civilization once flourished and in the 7th century AD, Islam was established. There are many precious properties and sites or religious places that remain throughout the country. Following three sites near Baiji have been registered in the World Heritage List.

(Refer to Figure 6.3.1-1 Natural Protected Areas and Ramsar Site in Iraq):

- A. Ashur (Qal'at Sherqat) (2003) (World Heritage in Danger)
- B. Hatra (1985)
- C. Samarra Archaeological City (2007) (World Heritage in Danger)



○ World Heritage ○ Natural Protected Areas ○ Ramsar Site

A	World Heritage - <u>Ashur (Qal'at Sherqat)</u>
B	World Heritage - <u>Hatra</u>
C	World Heritage - <u>Samarra Archaeological City</u>

Figure 6.4.4-1 World Heritages in the region

A. Ashur (Qal'at Sherqat) <http://whc.unesco.org/en/list/1130/>



Figure 6.4.4-2 Ashur (Qal'at Sherqat)

B. Hatra <http://whc.unesco.org/en/list/277>



Figure 6.4.4-3 Hatra

C. Samarra Archaeological City



Source: <http://whc.unesco.org/en/list/276>

Figure 6.4.4-4 Samarra Archaeological City

These historical heritage sites are located at the areas more than 50 km far from Baiji.

7 Environmental and Social Impacts and Mitigation Measures

The results of the potential environment, personnel health and safety (HSE) and social risks of the project activities identified and the corresponding assessments for the activities in the respective project phases, i.e. construction, operation and decommissioning/ abandonment, are indicated in the “HSE and Social Impact Assessment Sheet” (Table 7.1, 7.2 and 7.3) attached at the end of this section. The risks listed in the sheets include the activities in a normal (routine) operation and in accidental (non-routine) event associated with the construction and operation of the facilities proposed. The findings are described as follows.

7.1 Construction Phase

7.1.1 Physical Environment

(1) Air Emissions

The construction activities will contribute to the deduction of air quality at the project area through the emission of exhaust gases such as nitrogen oxide (NO_x), sulfuric oxide (SO_x) and particle matters (PM) from the construction equipment and vehicles as well as dust occurring from earth works and driving vehicles within the site and adjacent area. It is expected that the air emission from the construction activities will potentially cause objectionable effect on the local community.

The mitigation measures on such impacts will be implemented by the following manners:

- Proper maintenance of construction machines and vehicles to maintain in good conditions
- Reconditioning of access roads
- Control of traffic
- Use of dust proof covers and water sprinkling
- Proper soil moving/control

The proposed construction site is the vacant facility area in the existing refinery boundary, which has been prepared for future expansion of the facilities. Therefore, the work for leveling of the site is limited. Through serious implementation of the above mitigation measures by the construction contractor under the NRC’s strict control, the potential adverse impacts on the atmosphere will be minimized within the acceptable level. Also minimizing the construction

extent and construction period (at least several years) will contribute to the reduction of the impacts.

The nearest residential area is located at the south of the Baiji Refinery and the distance from the construction site in the refinery is approximately 3 km. Therefore, it is expected that the impacts of the construction activities on the air quality of the residential area is not significant.

In addition to the above, for protection of worker's health from the dust emissions, the workers will be required to wear proper protection equipment such as masks and goggles in accordance with the applicable HSE work procedure at their work places.

During construction, the air quality (dusts in calm weather) in and around the site areas including the nearest residential area will be monitored in accordance with the monitoring plan provided by the construction contractors.

(2) Water Quality

The site is located in the plain land with high underground water level extended in the Tigris river basin. Improper controls of wastewater and hazardous substances discharged or released by the construction activities may cause pollutions of surface water and underground water bodies in or adjacent to the site consequently. The sources of wastewater include sewage and effluent water from the construction offices and camps, oily wastewater, storm (rain) water, hydro-testing water of the equipment and pipelines and the accidental leaks/spills of fuels and chemicals, etc.

The sewage water discharged from the construction camps and offices will be treated using appropriate treatment equipment conforming to the relevant regulation of the country or the project water quality standard.

The project area is a low rain region in Iraq (about 20 days in a year), however, there are several days of heavy rain and thunder storm normally in winter season. The project site is located at the designated plant area in the boundary of the existing Baiji Refinery with the storm water drainage system. The storm water is flown out to the water canals around the refinery, which are connected to the Tigris River. Such drainage system is expected to minimize the impact of the storm water on the surface water body such as Tigris River due to disruption of direct drainage of the storm water from the construction site.

After the installation of the equipment and pipelines, hydro-testing will be carried out for evaluation of the air-tightness of the lines. The equipment and pipelines will be filled with

filtered water and a certain dosage of chemicals (corrosion inhibitor, biocide, etc.) may be added to the testing water. After completion of the testing, the testing water will be discharged to the drainage system designated previously.

In order to mitigate the impacts of the chemicals, the approved low toxic type of chemicals will be selected in accordance with the relevant regulation of NRC.

At the construction site, the fuel storage tanks and re-fueling equipment will be provided. If such hazardous liquid leaks on the ground, it may cause the pollution of surface or underground water by penetration into the soil. To prevent diffusion of the spilled liquid on the ground and penetration into the soil, the equipment will be installed on the paved location and a proper embankment or bund wall with sufficient volume will be provided around the storage tanks.

It is evaluated that the impacts of the construction activities on the water bodies in and adjacent to the site are insignificant and the affected period is relatively short.

(3) Wastes

The construction activities will discharge various wastes including hazardous and non-hazardous substances such as garbage, sewage wastes, construction residues, steel scraps, spent oil and chemicals, etc. These wastes, if no proper treatment and control are made, will cause soil and water pollution as secondary impacts.

The basic policy for the waste management is to minimize its occurrence and reduce the volume. Inventory of the respective wastes will be estimated based on the detailed construction plan prior to commencement of the construction. The wastes discharged from the construction site will be segregated respectively according to the types and hazardousness/ toxicity, stored and treated or reused/recycled properly in accordance with the Waste Management Plan (WMP) provided by the construction contractor. The waste treatment and ultimate disposal methods will be developed in compliance with the applicable laws and regulation of the country and/or the international practices in the subsequent FEED phase.

It is evaluated that the impacts of the wastes discharged from the construction activities will be insignificant, that is if the proper waste management plans are implemented properly under strict control of NRC.

(4) Soil and Topography

No soil contamination is expected because the designated project site is the un-used area designated for the future expansion of the facility. Prior to basic engineering of the FCC Complex, a comprehensive site engineering survey will be conducted, which will include the survey of current pollution conditions of the site area. If any polluted area is observed, the extent and conditions will be assessed whether it needs to be treated for restoration.

The soil pollution can be caused by improper controls of wastewater and solid and liquid wastes in the construction activities and unexpected leak/spill incident of harmful fuels or chemicals. It is expected that potential soil pollutions can be prevented or mitigated by proper controls/treatment of the wastewater and wastes discharged and proper protection measures for spill/leak of harmful liquids.

The impacts on the soil pollution are evaluated to be not significant. However, if large soil pollution occurs once, the affected period of the pollution will be longer.

The project site for the proposed FCC Complex is designated in the plant area of the existing Baiji Refinery. The area has been already prepared in the refinery boundary for future expansion. Therefore, the project will not be associated to cause any change in the topography of the area.

In addition to the refinery plant, a new water intake station will be provided at the bank of the sub-stream of Tigris River. The exact location and the extent of the facility will be studied properly in the subsequent phase of the project. The study should be developed with consideration on how to minimize the footprint of the construction and the potential impact on the stream.

(5) Noise and Vibration

Construction equipment and vehicles utilized for construction activities at the construction site will create unavoidable noise and vibration. The potential receptors of the phenomenon will be the residents of the local community and the workers of the construction.

The noise generated by the construction equipment and vehicle will be reduced by employing a good maintenance and operating practice and the installation of proper silencer device. The highest sources of large sounds and vibrations will be the pilling operations of the civil work, in general. Using the noiseless and no-vibration pilling method will mitigate the possible impact on the residents, if it is available in the region.

The noise generated by the construction activities shall be controlled in accordance with the requirements of the applicable regulation and/or project specification defined previously.

- Environmental standards : Maximum allowable noise (hourly average)
 - Residential area: Day-time 55 dB(A), Night-time 45dB(A)
 - Industrial and commercial area: 70 dB(A)

The workers to be directly affected by the noise at the construction site are required to wear the appropriate noise protection equipment while working in accordance with the occupational health and safety procedure of the construction safety management plan, which shall be developed by the construction contractor.

The nearest residential area is located at approximately 3 km south from the construction site in the Baiji Refinery. Such reasonable distance from the source will contribute for sufficient attenuation of the noise at the residential area. Also between the construction site and the boundary of the refinery, there is an extensive oil tank farm, which will function effectively for buffer of noise emission to the residential area. Furthermore, the working hour will be limited in the day-time basically in order to mitigate the expected impact on the residents in the surrounding areas to the construction site.

It is evaluated that the impacts of the noises and vibrations from the construction activities on the local community are not significant. However, it is necessary to monitor the noise level at the residential areas adjacent to the refinery or at the boundary of the refinery before and during construction for evaluation of the increased noise impacts.

7.1.2 Ecology

As described in the Section 6 regarding the baseline environmental conditions of the project site, the ecological/biological diversity including vegetation and wildlife communities in the project region is low and the habitats of some bird families are only observed sparsely in the limited locations in the region. The proposed FCC Complex will be installed in the existing refinery plant area, so that it will not cause any direct disturbance to the local ecological system by loss of habitat for the wildlife. Such site selection will contribute to further mitigation of the impacts on the existing low ecological system in the region.

Furthermore, proper control of the wastewater and wastes discharged from the construction activities will also be effective to mitigate the impacts on the limited ecological system in the affected area.

Accordingly, it is expected that the potential impacts of the construction activities on the existing ecological system in the project region will be insignificant.

A new water intake system consisting of the water intake station and water transfer pipeline will be provided. The water intake station will be located at the bank of the sub-stream of Tigris River. The river bank area with reed marshes is sensitive to the wildlife especially for the birds. For selection of the location of the facility and the route of the pipeline, proper considerations for the minimum impacts on the sensitive area should be based on the findings of the ecological baseline survey for the region.

The National Protected Areas named “Wadi Tharthar Lake and Marshes” and Key Biodiversity Area “Huweiji Marshes” are located at the area approximately 50 km south-west and 40 km east from the project site respectively.

According to such far distances, no impact of the project on the protected areas is expected.

7.1.3 Socio-Economic

The first approach to the socio-economic impact assessment of the project should be the identification of the stakeholders, who will be affected potentially by the project. They comprise the residents in the local communities, the state and municipal governments, related institutes, industrial, agricultural and commercial firms and individuals, journalists, etc. Consequently, the social-economic assessment should be made appropriately through dedicated social baseline survey, disclosure of the project planning and consultations to the public in order to collect the necessary information to ensure that the social impacts associated with the project are assessed accordingly.

(1) Land acquisition and resettlement

The Baiji Refinery was built in 1978 at the land acquired from the government in compliance with the relevant legislation. The proposed FCC Complex and related facilities will be constructed at the vacant area provided for future expansion of the facility within the boundary of Baiji Refinery. Therefore, no further land acquisition will be required for construction of the FCC Complex.

Meanwhile, as described earlier, the new water intake station with a water transfer pipeline (approximately 7 km length) to supply the industrial water to the FCC Complex will be

constructed at the new location. The new water intake station is planned to be located at the bank in the upstream of Tigris River and the pipeline will be routed in parallel with the domestic road passing through the northern rural area of the refinery. The land for the water intake station and the right of way (ROW) for the pipeline will be acquired formally from the government in accordance with the legislation of the country.

The land needed of the new water intake and supply system is estimated approximately 2.11 km² (2,1 km² for pipeline ROW (30m wide) and 0.01 km² for the intake facility) for the construction temporarily and 0.85 km² (0.84 km² for pipeline ROW (12m wide) and 0.01 km² for the intake facility) for operation permanently.

The pipeline will be buried completely along the route in the ground and the site will be reinstated in the previous status after completion of the construction.

According to the literature investigation, the land needed for the construction of the new water intake system including the pipeline route seems to be available and not used for residence, agriculture or the other purposes by the local people at the present. Therefore, it is expected that the land acquisition for the construction of the water intake system will not cause any resettlement of the residents and thus will not affect any livelihood of the local people.

However, it is necessary to further investigate the probable uses of the land by the local people through the site survey and direct consultation with the local community in the subsequent FEED phase of the project. If any people, who uses the land for farming or grazing and the land provide positive gains to their lives, are confirmed through the survey, the project will discuss dedicatedly the necessary compensations for them with the relevant authority of the region, regardless whether they are formal or informal land users.

The project will develop the Land Acquisition Plan defining the procedure and formalities necessary for such acquisition of the land in accordance with the relevant legislation of Iraq and the environmental and social guideline of JICA/JBIC. Further, where the project is implemented by JICA ODA loan, the appropriate compensation for the owners/users of the land shall be discussed seriously between MOO/NRC and JICA in compliance with the both requirements of the relevant law in Iraq and the environmental and social guideline of JICA/JBIC in the subsequent FEED phase.

(2) Local traffic

The transportation of construction workers, materials and equipment will be made through existing road system commonly used by the local community adjacent to the project site. It is

highly expected that such transportation activities will disturb local traffic along the main roads in the region from the base of logistic to the site. Probable traffic related conflicts and accidents due to the increased project vehicles will become a major concern for the local residents.

For mitigation of such impact, a comprehensive traffic management plan, which will control the routes and time for the operations and safety measures, will be discussed properly with the local community and the relevant authority of the region prior to the construction.

(3) Migration of outside workers

The construction works of the project will need many skilled and unskilled workers in the various fields. The construction contractor will mobilize necessary workers from the local areas and/or from other areas including foreign countries. Though the numbers of the workers from outside are not expected exactly in this stage, such migration of outside workers may affect potentially the circumstances of the local community due to difference of culture, lifestyle, religion, etc. from the region.

NRC will designate the area for the camps and offices for the contractor within the boundary of the Baiji Refinery. Doing so will isolate the migrated construction workers from the local community. The effective mitigation measures to be undertaken by the contractor for this concern includes proper control of the numbers and origins of outside workers, maximum employment of the local workers, minimal opportunities of contacting with the local community, and education for understanding the cultures and lifestyle of the region. Furthermore, the construction contractor will provide the appropriate construction camp management plan for controlling the workers for prevention of the probable conflicts with the local community, which includes the rules of activities in the camp such as strict curfew, prohibitions of alcohol and drugs, health controls of the workers both physical and mental cares and education for the issue of local infectious disease and HIV.

(4) Local infrastructure

All the utilities necessary for the construction activities such as power, water, fuels will be self-supplied by the construction contractor without the use of local utility network. Accordingly, the limited local utility supply system will not be affected by the construction activities.

The existing local road system will be use for transportation of the materials and project personnel. However, for mitigation of the potential impact on the local traffic, the operations of the project related vehicles will be controlled appropriately in accordance with the traffic

management plan provided by the construction contractor. If any road is damaged by the construction vehicles, the contractor will restore the damaged portion to its proper conditions.

(5) Employment

In the construction phase, the project will need a number of construction workers consisting of skilled and unskilled workers and competent engineers in various fields. It will also create the certain opportunities for direct employment from the local area accordingly. The construction workers will be mobilized by the construction contractor from the local and/or outside and NRC will also mobilize sufficient numbers of project members including engineers for management and supervision of the works. Furthermore, other job opportunities are expected indirectly for various services such as procurement and supply of goods, transportation, catering, etc.

However, the construction period will be relatively short (several years) and the employment will be generally temporary in general. NRC will estimate the personnel required and periods for the construction in subsequent FEED phase.

On the other hand, the potential adverse impacts will be the excessive expectation for the job opportunities and anxiety and doubt for the fair employment among the job applicants in the local community.

For mitigation of such adverse impact, NRC will disclose the information regarding the project in the earlier time in accordance with the Information Disclosure and Consultation Plan of the project and the construction contractor will develop the recruitment plan including the job training program through discussion with the relevant local authority. The recruiting activities will be implemented fairly and openly by the construction contractor in accordance with the instructions given by the local authority.

(6) Historical and Cultural Heritages

The project site will be located at the designated facilities areas within the boundary of the existing refinery plan area and the limited adjacent area. According to the literature investigation and the information supplied by NRC during the study, no historical and cultural site is confirmed in and around the project site.

On the other hand, there are three registered World Heritages, i.e. Ashur (Qal'at Sherqat), Hatra, Samarra, in the same and neighboring provinces. These heritages are located at the areas more than 50 km far from the project site, so that, it is expected that the project activities will not cause any impact on such valuable sites.

7.1.4 Personnel Safety and Health

The plans for all construction activities of the project shall provide the necessary protective measures to deal with potential hazards that threaten the people, environment and properties. The potential hazards in the construction phase are as follows.

- Hazardous working conditions (location, space, temperature, air quality, light, noise, toxic/hazardous materials, machine/equipment/tools, hygiene, etc.)
- Traffic accident
- Fire and explosion
- Exposure and leak/spill of hazardous material (fuels, chemicals, etc.)
- Incident in the work places
- Disease
- Disturbance by third party

It is expected that these potential hazards can be mitigated by providing appropriate project plan and suitable construction procedures, methods, and implementation of the management plans for the hazards as well as training for the project members including construction contractors.

To ensure personnel safety and health for construction, a proper safety and health management plan will be provided by the construction contractor which is consistent with NRC's HSE policy and strategy. The plan will include individual specific plans such as safety work plan, traffic safety plan, hazardous material management plan, construction camp management plan, safety training plan, security plan, etc.

In addition to the above, to mitigate and/or minimize the impact of the incident, when it happens, the proper emergency response plans shall be provided in accordance with the best available practices, which deal with fire, oil spill, injury or fatal accident, disease, storm, etc. The construction contractor will provide the functional emergency response plans covering respective potential incidents that could occur during the construction. The plan shall consist of necessary organization, resources and information communication procedure, etc.

NRC will develop the comprehensive Incident Management Plan (IMP) addressing the respective possible incidents in the subsequent phase of the project.

7.2 Operation Phase

7.2.1 Physical Environment

(1) Air Emissions

The proposed FCC Complex will include a number of stationary emission sources which may impact air quality in the region as follows.

- Combustion equipment in the processing units and utility facility
 - Fired heaters, tail gas incinerators, steam boiler
 - Diesel engine/ Gas turbine drivers of power generator
- Flare stack and emergency venting system
- Fugitive VOCs from processing equipment, oil storage tanks, oily drain system, etc.

The combustion equipment will emit exhaust gas containing NO_x, SO₂, CO, PM and other pollutants into the atmosphere during operation of the facility. The process equipment and oil storage tanks will also release fugitive hydrocarbon gas (VOCs¹) from their venting devices continuously or intermittently.

The extent of emissions of the harmful pollutants in the flue gas i.e. NO_x, SO₂, CO, PM will be specified in the design phase to comply with applicable emission standards of the country or international guidelines. Furthermore, the flue gases from the combustion equipment will be discharged from the high stacks properly designed for effective diffusion into atmosphere.

A vent system will be provided to collect fugitive photo-chemically active VOCs from the equipment. The collected vent gas and the waste gases discharged from the processing units are burnt in the atmosphere by the flare stack, which is adequately designed for highest combustion efficiency of the gas and sufficient diffusion of the flue gas in the air.

In the emergency case, the gas in the equipment is blown out by the safety devices on the equipment and released in the atmosphere through the vent stack of the emergency vent system. The vent stack will be designed properly to ensure sufficient diffusion of the gas in the air. In addition, the closed oily effluent water system will minimize releasing VOCs from the oily drain stream in the plant area.

Such measures will contribute to mitigate properly the impact of the gas emissions on the air

¹ Volatile Organic Compounds are organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere.

quality in the surrounding area.

In this phase of the project, it is impossible to assess exactly the impact of the gas emissions from the new FCC Complex on the air quality of the region, since the detailed facilities plan and the inventories of the gases discharged from the facilities have not been finalized yet.

In subsequent FEED stage, the inventories of the gases emitted from the facilities shall be estimated based on the results of the basic engineering for the facilities by using adequate means. Based on the gas emission inventories and the conditions of the respective emission sources in the facilities, an atmospheric dispersion modeling study shall be undertaken in order to estimate the ground level concentrations for the pollutants. The outcomes of the modeling study will provide necessary information for prediction of the air quality in the sensitive area such as the nearby residential area which will be potentially affected by the operation of the facilities.

In addition to above, the atmospheric dispersion modeling shall be also applied to the entire gases emitted from the whole combustion equipment included in the existing facilities in the Baiji Refinery for assessment of **the cumulative impacts** on the air quality in the residential area whether it complies with the air quality standards or not. If the estimated air quality at the sensitive area is excessive than the standards, further mitigation measures shall be discussed in the engineering activities.

In the operational phase, regular measurements of flue gases from each emission source and the air quality at the specific points shall be implemented in accordance with the Environmental Monitoring Plan (EMP) established by NRC for verification of compliance with the applicable standards and effectiveness of the protective measures undertaken by the project.

(2) Water Quality

The wastewater including oily and sour water is discharged from process equipment and the other equipment during operation of the facilities. The operation and maintenance works in the refinery will also necessitate the discharge of wastewater from the work sites. Such wastewater contains oil and other contaminants/pollutants such as residual chemicals, suspended solids, etc. The new FCC Complex will provide two separate drain systems for the oily drain and rainy drain systems similar to the existing plants in the Baiji Refinery. The oily wastewater is collected in the closed oily drain system and the oil content is eliminated by the capable wastewater treatment system provided in the facilities in accordance with the specific standards of NRC.

On the other hand, sanitary water is discharged from the offices and the buildings including the control rooms and work shops. The sanitary water discharged is also treated by the appropriate sewage treatment system in accordance with the applicable standards.

The treated water is collected at the settling basin together with the storm water drain and the water is eventually flowed out to the water channel around the refinery, which is connected to the sub-stream of the Tigris River.

With proper and functional water treatment system in place, it is expected that the wastewater discharged from the new facilities will cause insignificant impact on the water body surrounding the project site.

The volume and properties of the wastewater discharged from respective sources in the FCC Complex will be estimated adequately based on the nature of the processing units and equipment defined by the basic engineering in the FEED phase. Configuration of the above wastewater treatment system and specifications of the treatment equipment will be also decided properly in accordance with the applicable regulations and standards.

In operation phase, the actual inventory and quality of the above wastewater discharge from the operations of the new facilities shall be monitored periodically in accordance with the Environmental Monitoring Plan (EMP) developed prior to starting up of the new facilities.

The EMP shall include the monitoring of the wastewater discharged from the existing and new refineries for assessment of the expected cumulative impacts on the water quality of the Tigris River.

(3) Wastes

Routine operations of the FCC Complex are expected to generate relatively limited wastes. The types of the wastes generated by the facilities operations are listed below.

- Non-hazardous wastes: paper, wood, metal, glass bin, foods wastes, garbage, etc.
- Hazardous wastes: spent catalysis, oily rags, empty drums, spent oil filters, battery, fluorescent lamp, etc.
- Hazardous liquid wastes: spent oil & lubricants, oily sludge, paint, chemicals, solvent, etc.

The generated wastes will be properly segregated according to hazardous and non-hazardous properties in compliance with the applicable standards of NRC and relevant laws. The respective wastes segregated are properly stored temporarily in the designated location in the

refinery and eventually treated or disposed in accordance with the operations Waste Management Plan (WMP) developed by NRC. The transportation, treatment and ultimate disposal of such wastes will be properly monitored by the tracking system provided in the WMP.

The inventory of the wastes generated by the facilities operations will be estimated preliminarily based on the process and the other equipment and operation methods as well as necessary maintenance activities of the facilities defined by the basic engineering. The practical treatment procedure of the wastes including **the spent catalysis** regularly discharged from the processing units and **the slag/metal cake** discharged from the gasification unit will be discussed properly in the FEED phase of the project.

Proper implementation of the waste management plan for operation will contribute to mitigate effectively the environmental impact arising from the wastes generated from the facilities operation.

(4) Soil

As described in above clauses, the various waste materials such as wastewater and hazardous wastes, which potentially cause the soil pollutions, will be discharged during the normal operations of the FCC Complex. These waste materials will be properly treated or managed in compliance with the NRC regulation and the standards specified by the relevant laws.

Accordingly, it is expected that the facilities operations will not significantly affect the quality of soil in the site, if the measures drawn out are properly implemented.

The operations of the facilities and treatment of the waste materials are limited within the boundary of the Baiji Refinery, that no direct impact on the soil and land outside the boundary is expected.

However, once the oil spill occurs in the refinery or from the pipeline extensively, it may cause serious pollutions of the land and it will take a longer period for the recovery of the polluted soil/land in and around the project area. Therefore, a proper leak and spill prevention measures and the rapid and proper response actions for the spills will be necessary for the mitigation of the impacts.

(5) Noise and Vibration

The operation of the refinery will present various permanent sources of noise in the facilities,

which include not only the continuous noise sources i.e. mainly rotating equipment such as diesel engines, compressors, pumps, etc. and the flare stack, but also the intermittent noise sources i.e. blowing off of safety valves on the steam boiler and other equipment. In operation phase, no source of big vibration is foreseen in the facilities.

The project will provide the appropriate standards of the noise emitted from the source equipment in accordance with the applicable regulations of the country and related international guideline in order to mitigate the probable noise impact on the residents in adjacent area of the refinery and the operational personnel in their work site. Accordingly, the project will specify the maximum noise level of the source equipment and discuss the appropriate measures to reduce and isolate the noises by silencer, sound-proof enclosure or housing in the engineering of the equipment.

In order to protect the health of the operational personnel at site, NRC has a safety/health work procedure to wear the suitable protective gears at the noisy work places.

The nearest residential area is located at approximately 3 km south from the project site. There is an extensive tank farm between the plant area where the source equipment of the noise, and the southern boundary of the refinery, which functioned effectively as buffer zone of noise emissions. Accordingly, the noise level of the operating refinery at the residential area is likely to satisfy and be within the environmental standard required by the relevant laws of the country.

According to the above mitigation measures and the situation of the project site, it is expected that the noise impact on the personnel at work site and local community will be not significant.

In order to assess the noise levels exactly, whether noise levels at the refinery boundary will comply with the standards, a noise modeling shall be undertaken in the subsequent FEED phase according to the noise sources equipment defined by the basic engineering. The study shall include the baseline noise survey at the refinery boundary and the residential area and the cumulative impact with the operation of the existing refinery.

In addition, during operation, the effectiveness of the mitigation measures provided by the project shall be verified through regular measurement of the noise levels at the specific points in accordance with the noise monitoring plan established by NRC.

(6) Odor

Potential major sources of odor in the FCC Complex include the impurities of hydrogen sulfide (H₂S) and mercaptan contained in the intermediate products of LPG and FCC gasoline. These

impurities are eliminated suitably by the sweetening unit and de-mercaptan unit to be composed in the process units of the FCC complex.

The NO_x included in the flue gases discharged from the combustion equipment such as oil heaters, steam boilers, diesel engines, etc is the source of discomfort odor for the people. In addition, the flare stack for incineration of the waste gas from the processing units is also one of the possible emission sources of odor.

For mitigation of such potential odor emissions, the project will specify exactly to introduce the low-NO_x type of combustion equipment and the high combustion efficient flare burner of the flare system in engineering of the proposed FCC Complex.

Through the above protection measures, it is expected that the potential odor emitted from the facilities will be mitigated properly.

7.2.2 Ecology

The operations of the FCC Complex will be limited within the boundary of the existing Baiji Refinery. It certainly will contribute to avoid the direct impact on the wildlife habitats in the region. The pollutants included in the gases emitted from the facilities and the wastewater discharged to the water body in the region are controlled properly in accordance with the standards specified by the project and applicable laws. Such measures will also contribute to mitigate the possible degrading of the environment and wildlife habitats in the region.

Therefore, it is expected that the potentially additional impacts on the ecology in the project and surrounding areas due to new operations of the FCC Complex is effectively mitigated through such environmental protection measures.

The actual impacts of the continuous refinery operations on the ecology in the region can be assessed through comparison of the information collected by the ecological baseline survey to be conducted in the subsequent phase of the project and the periodical monitoring investigation in the operation phase. The ecological monitoring shall be included in the environmental monitoring plan in the operation phase for assessment of the ecological impact of the project and evaluation of the effectiveness of the protective measures undertaken.

7.2.3 Socio-Economics

(1) Livelihood of local community

The operational activities of the new FCC Complex will be limited in the boundary of the existing Baiji Refinery. Accordingly, the routine operation of the FCC Complex is expected to cause no significant direct impact on the livelihood of the local community.

Meanwhile, the addition of the FCC Complex in the Baiji Refinery will result in the increase of the vehicles for material and personnel transportation necessary for operation and maintenance as well as loading of the products. These vehicles will use the existing local road network in the region and it may disturb potentially the traffic of the local community.

For mitigation of such impact on the local traffic, NRC will develop the traffic management plan in the operation phase in consultation with the relevant local authority and community, which specifies the traffic routes and time schedule as well as the safety measures of the vehicle operations according to the types and numbers of the vehicles involved.

Accordingly, it is expected that the impacts of the operational activities of the new facilities on the local community will be low.

(2) Landscape

A new installation of the large scale of refinery plant will associate some permanent change for the landscape in day and night time from the residential areas adjacent to the plant and it may cause the impacts on the residents visually or psychologically.

The proposed FCC Complex will be constructed in the vacant plant area in the existing Baiji Refinery consisting of various large refinery facilities and it will occupy one quarter of the plant area of the refinery.

The nearest residential area is located at approximately 3 km south from the site of the new facilities. The extensive tank farm of the refinery is located in between the new facilities and the residential area. Therefore, the possible change of landscape from the residential area due to additional installation of the FCC Complex in the existing refinery is low even in the scenery in night time.

(3) Local infrastructure

The electric power for the Baiji Refinery is currently supplied by the regional power grid which is separate from the public use power system in the community. In addition, the project considers providing the in-house power generation system in the FCC Complex utilizing the

fuel gas produced by the optional gasification unit.

The industrial water, on the other hand, will be supplied directly from the Tigris River through the new independent water intake and supply system for the FCC Complex.

According to the operation of the FCC Complex, the increased vehicles for transportation of materials, personnel and products will somehow disturb the present stable traffic of the local road network in the region. However, the traffic management plan provided by NRC will contribute to mitigate the potential impacts on the local traffic through proper control of the operational vehicles.

Accordingly, it is expected that the potential operational impacts of the FCC Complex on the infrastructure in the region will be insignificant.

(4) Employment

In the operation phase, a number of operation and maintenance personnel will be allocated to the FCC Complex. The operations of the new facilities will create a certain opportunity for direct employment of local people by NRC for such operational resources. It will also create corresponding other job opportunities for related services such as material procurement, transportation, fabrication and repair works and so on. Such effects are expected to be sustained during the operational period of the refinery.

Numbers of operational personnel required will be estimated by NRC in FEED phase of the project. Prior to operation, based on the personnel planning for the FCC Complex, NRC will provide fair recruiting campaign for the local community in order to mitigate the probable adverse impact on the local people, such as anxiety, envy and excessive expectations.

(5) Local economy

As described before, the project will create new employments in the region directly and indirectly in the operation phase. In addition, various related business opportunities will be also created in the region including supplies of the materials, goods, foods, etc. necessary for the operations of the refinery and services such as material supplies, transportation, fabrication and repair of equipment and so on.

The new employment and activated businesses will promote revitalization of the local economies and development of regional and the country's economy by the taxation revenues from the business firms. Consequently, according to the increase in incomes of the individuals, the livelihood of the local community is expected to be improved gradually.

On the other hand, the improved economies of the region could also provide potential adverse impacts, which include wage differentials among people, price inflations, social anxieties, conflicts between local residents and migrated personnel as well as crimes due to increased population in the region.

NRC will provide the appropriate social programs to support the mitigation of the probable concerns in the local community in collaboration with the regional government in respective subsequent phases of the project.

7.2.4 Personnel Health and Safety

Assurance of health and safety of the people in the work places and the community in the region is the first objective of HSE policy of NRC.

The potential incident that could occur in the refinery plants during the operation phase could deeply affect the health and safety of operational personnel in the site. In a case of crucial accident such as fire and explosion of the facility and massive spill/release of oil or toxic gas, it could affect severely the health and safety of the people of the community near the refinery.

The preventive measures for such incident and accident in the operations to be considered in the project and operation of the facilities are discussed below.

(1) Facilities and Equipment

The integrity of the facilities i.e. safety, high operability and reliability, is ensured by proper design of the facilities and equipment with high level of control and safety systems. The facilities and equipment will be designed in accordance with the related international standards and practices widely recognized in the refinery sector in the world and applicable laws and regulation of the country based on the 25 years operational life of the plant.

The potential hazards and risks in the process and control system designed will be reviewed and analyzed through HAZID ¹, HAZOP ², QRA ³ or other methods of similar exercise in the respective engineering phases in accordance with the international guidelines and practices. The outcomes of the exercise will be fed back to the design of the facilities, equipment and system for further improvement, upon required.

¹ Hazardous Identification Study

² Hazardous Operability Study

³ Quantitative Risk Assessment

(2) Safety Systems

The complicated processes and operations of the process units and equipment in the FCC Complex and the related facilities will be monitored and controlled with an advanced computerized central and remote control system so called Distributed Control System (DCS). The DCS includes the functions of the emergency shutdown of the facilities partially or totally in case of possible critical situation of the process of the facilities. Such system will be enabling the operation of the facilities steadily and safely.

The FCC Complex will be provided with adequate combustible gas and toxic gas (H₂S) detection system in the processing areas to ensure rapid alarm if any accidental leak of such hazardous gases occurs. In addition, an automatic fire detection and alarm system as well as fire fighting system will also be provided in the facilities. These safety systems will be designed properly in accordance with the requirements of the relevant regulations of the country and the international standards practically applied to the refinery in the world.

The above passive and active safety provisions will contribute to mitigate the potential risks on the facility and personnel during operation of the FCC Complex.

The FCC Complex will be one of major refinery plants comprising the Baiji Refinery and the safety of entire Baiji Refinery will be assured through integrated safety systems of the respective refinery plants. Therefore, the integration of the safety systems for the existing and new facilities shall be discussed together with upgrading of the safety systems of the existing refinery plants in the subsequent FEED phase of the project.

(3) Operation

NRC will develop the comprehensive operation procedure for the FCC Complex consisting of start-up, normal operation and shut-down of the facilities. The procedure will also instruct the proper operation method which will address possible abnormal situation such as defective operation of the equipment, malfunction of the control devices, etc. for recovery of the stable operation or shut-down of the facilities partially or totally depending on the severity of the situation. The procedure of the FCC Complex will be properly linked with the operation of the existing refinery plants and related facilities of the Baiji Refinery.

(4) Facilities Maintenance

In the operation phase, a dedicated maintenance plan for the facilities will be implemented,

which consists of predictive, preventive and corrective maintenance works. The regular shutdown maintenance is effective to evaluate the current conditions and earliest detection of any defects of the equipment. A routine checking of the equipment and systems is also effective to observe any defects and malfunctions of them.

NRC will develop the facilities maintenance plan for the FCC Complex and related facility including the interfaces with the existing refinery.

(5) Occupational Health and Safety

The environment and conditions of the work places in the facilities such as temperature, heat, noise, vibration, light, air quality, space, height, etc. are largely related to the health and safety of the work personnel. Proper provisions for ensuring appropriate work environment and conditions will be provided to the design of the facilities in the engineering phase in accordance with the relevant regulations for occupational health and safety in the country and the applicable international guidelines and practices.

NRC has developed the concrete safety work regulations for the operation of the existing Baiji Refinery including the area classifications and work permit procedure, i.e. hot and cold permits, crane operations, scaffolding, work in enclosed space and so on. These safety work procedures will be also applied equally to the operations of the new FCC Complex.

The personnel in the work places are strictly required to wear the specific Personal Protective Equipment (PPE) i.e. safety shoes, helmet, goggles, hand gloves, ear plugs/protector, mask, breathing gear, safety belt, etc. according to the nature of the work and the environment/conditions of the work place in accordance with the health and safety regulation of NRC. In addition, the body shower and eye washer stations, air respirator stations and the first kits will be provided at the appropriate locations in the facilities.

NRC will further develop the comprehensive health and safety procedures including the competence training programs for the operational staffs to be applied to entire Baiji Refinery in compliance with the latest requirements of the relevant laws and the international guidelines prior to commencement of the operation of the FCC Complex.

Proper implementation of the above health and safety measures is expected to mitigate effectively the potential risks on the occupational health and safety of the operation of the new facilities.

7.3 Decommissioning/Abandonment Phase

Decommissioning and abandonment of the facilities of the FCC Complex will be made after completion of the project (business) or termination of at least 25 years life of the facilities. The schedule of such decommissioning of the facilities has not been decided exactly yet for the time being.

The detailed method for decommissioning/abandonment of the facilities has not been discussed in this phase, because no definite plan for the end of production is available at present. The measure for decommissioning/abandonment of the facilities including options such as reuse for the other purpose will be discussed in compliance with the future business plan, applicable laws and regulations at the time after the decision of the schedule for the end of project (business) has been made.

The expected HSE aspects and impacts of the decommissioning/abandonment of the facilities, potential HSE impacts and considerations are assumed in Table 7.3 for reference. The summary is described as follow.

7.3.1 Physical Environment

(1) Environmental Pollutions

The definite environmental protection plans will be developed according to the nature and methods of the decommissioning/abandonment of the facilities.

The contents i.e. oils, water, gases, catalysts, etc. in the equipment and pipelines will be discharged safely after the operation of the facilities. The materials discharged as wastes will be disposed properly to the specific locations after treatment in accordance with the applicable laws and regulations at the time. The solid wastes discharged by removing and demolishing the facilities will be segregated for disposal, reuse and recycle based on the plan. Wastewater discharges from the works and the air emissions from the operations of the equipment and vehicles for the works will be controlled strictly in accordance with the environmental plan. The period of the works will be relatively short and the areas to be affected by the works will be limited in the Baiji Refinery.

Accordingly, the potential impact of the works on the environment of the region is expected to be insignificant, if the environmental plans are implemented properly.

Due to termination of operations of the facilities, pollutants discharges into the environment i.e. flue gases, effluent water, wastes, will be terminated, and therefore, improved environment in

and around the project site will be expected.

7.3.2 Ecology

The project site for the facilities will be cleared and reinstated to the previous conditions expectedly. Environmental recovery of the project site and the cessation of environmental emissions from the facilities operation will contribute to probable improvement of the environment of the wildlife habitats of the region.

7.3.3 Social impacts

The termination of the project (business) will take jobs from the employees and sub-contractors in the region. It will impact on the livelihood of the people involved in the operations and related works as well as the economy of the region.

NRC will disclose the plan for the termination of the operation to the public and discuss the plans for re-employment or new job training for job changes in an earlier time after decision of the decommissioning schedule for mitigation of the probable social impact.

7.3.4 Personnel Health and Safety

NRC will develop the specific personnel health and safety plan for the decommissioning and abandonment works according to the nature and procedures of the works. The plan includes not only the occupational health and safety for the workers, but also potential hazards due to accidental release of the hazardous substance from the facilities to the local community.

Such considerations will contribute to mitigate effectively the potential risks of the personnel health and safety.

7.4 Cumulative Impacts

7.4.1 Physical Environment

The proposed FCC Complex will be constructed in the area prepared for future expansion of the Baiji Refinery. After completion of the construction, the new FCC Complex will be operated simultaneously with the existing refinery plants of the Baiji Refinery. Therefore, the cumulative environmental and social impacts for operations of the entire Baiji Refinery including the existing and new plants are assessed as follows. The assessment shall be focused on the key

primary environmental aspects such as air quality, water quality and noise as well as social impact, which may affect the personnel health, the habitats of wildlife and the local community in the region, which will be affected potentially by the total operations of the refinery.

(1) Air Quality

The current air quality measured at the regular monitoring station near the Baiji Refinery is satisfactorily within the ambient air quality standards of Iraq. The harmful substances in the gases emitted from the combustion equipment will be complied with the applicable international guideline. Therefore, during operations of the both refineries, it is expected that the air quality of the nearby residential area will be also complied with the standards.

The predictive air quality in the residential area adjacent to the refinery will be assessed through the reliable gas dispersion modeling based on the inventories of the gases from respective emission sources in both refineries in the subsequent FEED phase of the project. The data required for such modeling will be collected from the specifications of the related combustion equipment defined by the basic engineering of the facilities.

In addition, the Baiji Power Station located at approximately 6 km north east of the refinery, is the other largest flue gas emission source in the region. Periodical air quality monitoring at the specific locations in the nearby residential area will provide actual data for assessment of the cumulative impact, whether it complied with the standards or not.

(2) Water Quality

The regular monitoring records show that the quality of the wastewater discharged from the existing facilities in the Baiji Refinery to the water canals connected to the Tigris River complied with the applicable standards of the refinery. The FCC Complex will be provided with the high standard of wastewater treatment facility in compliance with the both Iraq and International standards. Accordingly, the operation of the Baiji Refinery after completion of the FCC Complex is unlikely to have significant effects on the quality of the Tigris River.

The inventories of the wastewater discharged from the FCC Complex will be estimated according to the specifications of the source equipment of the wastewater in the subsequent FEED phase of the project. The expected impact of the wastewater from both the existing and new facilities on the water quality of the Tigris River shall be assessed properly based on the data including the properties and the pollutants of the wastewater using the appropriate manner.

The regular monitoring of the water quality of the river will provide the information necessary for assessment of the impacts of the operation of the refinery and effectiveness of the protection measures being undertaken.

(3) Noise

During the operations of the Baiji Refinery after completion of the project, the operational noises will be emitted from the equipment of the existing and new facilities to surrounding areas continuously. The distance of the nearest residential area from the plant areas, which contain the major source equipment of noise, is approximately 3 km and there is an extensive tank farm in between these areas. The tank farm also functions effectively as buffer of the noise emitted from the plant areas. Therefore, it is expected that the cumulative noise impacts of the operations of the existing and new facilities will be insignificant.

The expected cumulative impact of the noise emission on the residential area adjacent to the refinery will be assessed through the noise emission modeling in the subsequent phase of the project. The study will start from the identification of the sources and levels of noises in the existing and new facilities and being followed by the survey of the current noise levels at the nearby residential area and the boundary of the refinery as baseline.

The modeling will present the information for assessment of the expected noise impact on the sensitive area. The findings of the study will be reflected to the engineering for the facilities planning properly, if necessary accordingly.

A periodical measurement of the noise levels at the nearby residential area or boundary of the refinery shall be included in the environmental monitoring plan to be implemented in the operational phase of the project.

7.4.2 Ecology

Since the FCC Complex will be located at the project site prepared in the boundary of the existing Baiji Refinery, no direct cumulative impact of operations of the existing and new facilities on the ecology of the project site is expected.

On the other hand, the increased gas emissions and wastewater discharges from the Baiji Refinery may cause the degradation of environmental quality of the habitats of the wildlife in surrounding areas. Because of the project's serious compliance with the applicable standards for air and water qualities, no significant impact on the ecology in the areas is expected.

A long term monitoring by the specialists for the ecological conditions such as distribution and density of the vegetation, birds, animals, fishes, etc will reveal the possible change of ecological diversity due to the operations of the refinery and the effectiveness of the environmental measures being undertaken. Such ecological monitoring shall be included in the environmental monitoring plan in the operation phase of the project.

7.4.3 Social Environment

The operational activities of the proposed FCC Complex are limited mainly in the site of the existing Baiji Refinery. However, according to additions of the facilities, the vehicle traffic for material and personnel transportation as well as loading of the products will be increased in force and it may cause for disturbance of the local traffic in the region.

The numbers of the increased vehicles will be estimated in the FEED phase according to the facilities configuration and operation plan of the whole Baiji Refinery after completion of the project. NRC will develop the traffic management plan to mitigate the probable cumulative impacts of the refinery operations on the local traffic effectively by controlling the operations of the vehicles.

On the other hand, the additional installation of the FCC Complex to the Baiji Refinery will create new employment opportunities for the local community directly and indirectly. The project will also activate the industries and services in the region related to the operations of the expanded Baiji Refinery. Accordingly, the project is expected to promote further the economic growth of the region and improve the life and livelihood of the local community.

7.5 Non-routine Events

7.5.1 Incident/Accident

During operation, there is a possibility for various incident or accident to occur at the facilities such as fire, explosion, oil spill, toxic gas release as well as injury or fatality of the personnel at the site or neighboring residents. Such emergency event may be caused by unexpected defect or damage of equipment, control malfunction, improper work procedure, third party sabotage, natural disaster and others.

NRC has a functional emergency plan to respond to the incident occurrence in the existing Baiji Refinery for protection of the personnel involved in the event and environment. Moreover, prior

to operation of the FCC Complex, NRC will provide a comprehensive **Incident Management Plan (IMP)** to ensure all necessary preparedness for the incident and response actions to be taken for protection of the personnel, environment and assets in the entire refineries including the existing and new facilities. This IMP shall be developed properly based on the risks of the emergency events that could possibly occur in the operation of the facilities. The effective emergency response plans and strategies shall be capable of mitigating the consequences of the incident.

The IMP shall consist of the tiered emergency response plans depending on the severity of the event, the organization and responsibilities, internal and external communication procedure, capable resources (personnel, equipment and materials) necessary for execution of the plans. In addition, the medical services for the personnel, supports from the external organization and recovery procedures of the environmental and operational damage due to such event are included in the IMP.

The nearest residential area is located at the south of the refinery. The distances from the tank farm and the plant area to the residential area are approximately 2 km and 3 km respectively. Therefore, the direct impact of the accident such as fire or explosion of the facility, if happened, is expected to be insignificant.

However, in case of massive release of harmful or toxic gases from the refinery due to defective operation of the facilities, the gas emitted into atmosphere will affect potentially the health of the people in the area depending on the weather conditions. In order to assess the impact of the occurrence on the local residents, NRC will conduct the modeling study for the gas dispersion for prediction of the extent of the affected area and the possible concentrations of the harmful or toxic gas in the air at the residential area.

The findings of the study shall be reflected to the facility planning of the project and the IMP to be developed for the refinery.

The oil spill from the equipment, oil tanks or oil pipelines is one of the possible incidents during operation of the refinery. The oil spilled on the ground will cause the environmental impacts such as pollution of the soil/land, pollution of the adjacent water bodies i.e. river, swamp, lake and underground aquifer in the area, if any effective protection measures are not undertaken at the site.

All the oil storage tanks are provided with the capable containments (tank dikes) around the equipment. The facilities sites of the refinery are sectioned by the roads in and around the area of the refinery. Furthermore, the extensive buffer areas are prepared between the facilities area and the boundary of the refinery. These protection measure and area arrangements will

contribute to minimize effectively the diffusion of the spilled oil and limit the spread of the impact within the boundary of the refinery.

NRC will enhance the capability of the current preparedness for the protection of the possible oil spill event. **Oil Spill Response Plan (OSRP)** including necessary resources will be updated to address the potential oil spills in the existing refineries and new FCC Complex as well as the oil spills from the oil pipelines laid at outside of the refinery in accordance with the possible scenarios of the event.

7.5.2 Natural Hazards

The geodynamic configuration in the northern region of Iraq shows a medium to high seismic risks according to the historical dense cluster of earthquake in the region. However, Salahuddin province, central north region of the Iraq, in which the Baiji Refinery is located, is categorized a low seismic hazard (Zone 1).

The Baiji Refinery is located on the western plain land approximately 3 km from the Tigris River. The water of the Tigris River in the region is controlled by the Mosul Dam constructed in 1980s and it has decreased the potential hazard of flooding in the project region.

These potential geological hazards to the project region are expected to be low accordingly.

On the other hand, the visible unequal land subsidence has been observed in the limited facilities area of the Baiji Refinery in this decade. Detailed investigation for the phenomenon has not been conducted yet.

In the subsequent phase of the project, NRC will conduct the detailed investigation to understand and reveal the extent, severity, trends and the cause of the phenomenon including the effects on the project site of the FCC Complex. The results shall be fed back properly to the design and construction methods of the facilities, if necessary.

7.6 Green House Gas Emissions

The significance of Green House Gas (GHG) emissions associated with the operation of the proposed FCC Complex in a context of the country is discussed preliminarily as follows.

The total Carbon Dioxide (CO₂) emissions from consumption of fossil fuels in Iraq were 98.97

million metric tons in 2006.¹ The Baiji Refinery has a total capacity of 310,000 BPD currently and the CO₂ emissions from the facilities of the refinery are estimated at approximately 3.5 million tons per year.² The estimated increase of CO₂ emissions associated with the additional installation of the FCC Complex in the same refinery is approximately 0.53 million metric tons per year.

The CO₂ emissions from the current Baiji Refinery are equal to approximately 3.5% of the total CO₂ emissions in Iraq and the operation of the new FCC Complex will additionally bring approximately 0.5% increase of the total CO₂ emissions in the country.

Further study for assessment of the significance of GHG emissions from the refinery will be undertaken according to the facilities configuration of the FCC Complex defined by the basic engineering in the subsequent FEED phase.

¹ Source : Iraq energy profile data (October 2009), Energy Information Administration, USA

² Assumption: The average CO₂ emissions of refineries in the Middle east is 0.038 tCO₂e/bbl.

Table 7.1 HSE AND SOCIAL IMPACT ASSESSMENT SHEET (1 Construction Phase)

Project		Impact Severity Categories																		
Baiji Refinery Upgrading Project		High	Medium	Low																
Site																				
Baiji, Salahaldeen, Iraq																				
Project Phase																				
Construction																				
No.	Activities/ Works		Impact Receptor															Justification & Mitigation Measures		
			Physical Environment					Biological			Safety		Social							
			Atmosphere	Surface Water	Underground water	Soil	Topography	Landscape	Flora	Animals/Reptile/Fish	Birds	People	Assets	Life/ Livelihood	Land use	Local economy	Cultural heritage		Liability/ Reputation	
1	Land acquisition	FCC Complex site	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Since the project site is located within the existing Baiji Refinery boundary, no additional land acquisition is required.
		Auxiliary facility site (Water Intake & Transfer System)	-	-	-	-	-	-	-	-	-	-	-	L	L (M)	L	L	L	L	NRC will acquire the Land for the water intake station & transfer pipeline in accordance with the relevant laws. NRC will investigate the users of the land and provide appropriate compensation for the users consulting with the authority, if any .
2	Site preparation	Site clearing & Civil works	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Since the construction site is located in the plant area of Baiji Refinery prepared for future expansion, no large soil work will made. Accordingly, the impacts on the environment, ecology and community in the region will be mitigated satisfactorily. The contractor will comply with the HSE standards and regulations of the project seriously.
3	Construction	Installation & erection	-	-	-	-	-	L	-	-	-	L	L	L	-	L	-	L	The main works will be limited within the Baiji refinery area. The impacts on the ecology and community in the region are insignificant. Since the nearest residential area is approx. 3 km south from the site, no impact of the construction works on landscape from the local people is expected. The contractor will comply with the safety work procedure of NRC.	
		Equipment & vehicles operation	L	-	-	-	-	-	L	L	L	L	-	L	-	L	-	L	The construction equipment and vehicles will be maintained in good conditions to mitigate emissions of the exhaust gases. Low impacts on the air quality and ecology in the region is expected. Operation area and time are controlled properly to mitigate the probable impacts on the local people.	
		Noise & vibration	-	-	-	-	-	-	-	L	L	L	-	L	-	-	-	L	The construction site is located in the Baiji Refinery area. The nearest residential area is approx. 3 km south from the site and the extensive tank farm is laid out in between the areas. Low noise impact on the local people and wildlife is expected. The construction workers will wear the suitable noise protection gear in compliance with the occupational safety and health procedure.	

Table 7.1 HSE AND SOCIAL IMPACT ASSESSMENT SHEET (1 Construction Phase)

No.	Activities/ Works		Impact Receptor															Justification & Mitigation Measures	
			Physical Environment					Biological			Safety		Social						
			Atmosphere	Surface Water	Underground water	Soil	Topography	Landscape	Flora	Animals/Reptile/Fish	Birds	People	Assets	Life/ Livelihood	Land use	Local economy	Cultural heritage		Liability/ Reputation
		Wastewater discharge	-	L	L	L	-	-	L	L	L	-	-	-	-	-	-	L	The contractor will control the wastewater discharge in accordance with the requirements of NRC regulation and relevant laws. Such measure will mitigate the impacts on the water quality of the Tigris River and underground water as well as ecology in the region.
		Construction wastes	-	L	L	L	-	-	-	-	-	L	-	-	-	-	-	L	The construction wastes will be segregated properly according to hazardous and non-hazardous properties. The wastes are managed properly from generation to the ultimate disposal in accordance with the waste management plan (WMP) provided by the construction contractor. The WMP will be complied with the regulation of NRC and relevant laws of Iraq.
4	Transportation	Materials & workers	L	-	-	-	-	-	-	-	-	L	-	L	-	-	-	L	The construction contractor will develop the traffic management plan (TMP) consulting with the local community and related authority in the region. The TMP will specify the routes and time schedule as well as safety provisions for operation of the project vehicles.
5	Migration of workers	Construction camps	-	-	-	-	-	-	-	-	-	-	-	L	-	-	-	L	The construction contractor will prioritize to mobilize the workers from the project region. The construction camps will be located at the designated area in the boundary of Baiji Refinery to minimize the contact with the community and the appropriate camp management plan will be provided for managing the attitudes of the workers.
6	Employments	Direct & indirect	-	-	-	-	-	-	-	-	-	-	-	✓	-	✓	-	L	NRC and the construction contractor will disclose the information for recruits to the public in order to provide fair and equal job opportunities to the people in the region. The project will create a new job opportunities in the region directly and indirectly. It will contribute to improve the life/livelihood of the local people. The job period will be limited to construction phase, which is relatively short.
7	Material/Service procurements		-	-	-	-	-	-	-	-	-	-	-	✓	-	✓	-	L	The construction bulk materials and related services will be procured from local markets. It will contribute to enhance related industries and business and activate economy of the region.

Table 7.2 HSE AND SOCIAL IMPACT ASSESSMENT SHEET (2 Operation Phase)

Project	Baiji Refinery Upgrading Project
Site	Baiji, Salahaldeen, Iraq
Project Phase	Operation

Impact Severity Categories		
High	Medium	Low
H	M	L

No.	Activities/ Works	Impact Receptor															Justification & Mitigation Measures			
		Physical Environment						Biological			Safety		Social							
		Atmosphere	Surface Water	Underground water	Soil	Topography	Landscape	Flora	Animals/Reptile/Fish	Birds	People	Assets	Life/ Livelihood	Land use	Local economy	Cultural heritage		Liability/ Reputation		
1	Facilities Commissioning	L	L	L							L	L						L	The commissioning of the new facilities will be conducted properly in accordance with the procedure including safety measures to prevent the unexpected accident.	
2	Facilities operation	Operation & Maintenance activities	L	L	L	L						L	L						L	NRC will develop the appropriate operation and maintenance procedure including HSE measures and emergency response. The workers at the site are required to wear proper Personal Protection Equipment (PPE) in accordance with the safety work procedure of NRC. The periodical HSE training will be conducted.
		Gas emissions	L (M)							L	L	L	L						L	The combustion equipment (Furnace, heater, boiler, engines, etc.) is specified to comply with the gas emission standards of NRC. It will mitigate the potential degrading of air quality in the region including the wildlife habitats. Potential cumulative impact of the gas emissions from entire facilities of Baiji Refinery shall be assessed through a reliable gas emission modeling study in FEED phase.
		Wastewater discharges		L (M)	L	L				L	L	L	L						L	The wastewater discharged from the facilities will be treated properly by the wastewater treatment system in the refinery in compliance with the standards of NRC or relevant laws of Iraq. The treated water quality discharged to the external drainage system is monitored regularly. Such measures will contribute to prevent pollution of Tigris River, underground water as well as the environment of wildlife habitats. Potential cumulative impact of the wastewater discharges from entire facilities of Baiji Refinery shall be assessed properly in FEED phase.
		Wastes		L	L	L						L							L	The construction wastes will be segregated properly according to hazardous and non-hazardous properties. The wastes are managed properly from the generation to the ultimate treatment or disposal in accordance with the waste management plan (WMP) established by NRC. The WMP will be complied with the regulation of NRC and relevant laws of Iraq.

Table 7.2 HSE AND SOCIAL IMPACT ASSESSMENT SHEET (2 Operation Phase)

No.	Activities/ Works		Impact Receptor														Justification & Mitigation Measures			
			Physical Environment					Biological			Safety		Social							
			Atmosphere	Surface Water	Underground water	Soil	Topography	Landscape	Flora	Animals/Reptile/Fish	Birds	People	Assets	Life/ Livelihood	Land use	Local economy		Cultural heritage	Liability/ Reputation	
		Noise & vibration								L	L	L (M)						L	The FCC Complex is located in the Baiji Refinery area. The nearest residential area is approx. 3 km south from the site and the extensive tank farm is laid out in between the areas. Low noise impact on the local people and wildlife is expected accordingly Potential cumulative impact of entire operation of Baiji Refinery shall be assessed through a noise modeling study in FEED phase. The construction workers will wear the suitable noise protection gear in compliance with the occupational safety and health procedure.	
		Fuels & Chemicals		L	L	L												L	Hazardous material such as fuels and chemicals will be stored at the facility/equipment with secondary containment devices in accordance with the applicable regulation. It prevents to spread the hazardous liquid to outside, where spilled accidentally. NRC provides the safety procedure for storage and handling of such materials.	
		Utilities consumption (Power & water)												L					L	The electric power is supplied from the regional power grid separately from public use. The FCC Complex will provide an in-house power generation plant to self-supply the power required for operation. (optional case) A new water supply system will be provided to supply the industrial water from Tigris River.
3	Accident	Fire, explosion, oil leak, gas release, etc.	L	L	L	L			L	L	L	L (M)		L (M)			L		L (M)	Incident/accident preventive measures for the facilities and operations are discussed seriously in the engineering and design phase in accordance with the international standards, guidelines and practices widely recognized by the refinery sector in the world. NRC will develop the Incident Management Plan (IMP) addressing to the possible incident/accident in the entire operation of Baiji Refinery. Since the facilities are located in the extensive boundary of the refinery, no significant direct impact of the accident on the nearby community is expected regardless of occurrence. However, a detailed risk assessment shall be made according to the possible accident scenarios in FEED phase.
4	Transportation	Materials & personnel												L					L	The NRC will develop the traffic management plan (TMP) consulting with the local community and related authority in the region. The TMP will specify the routes and time schedule as well as safety provisions for operation of the vehicles.

Table 7.2 HSE AND SOCIAL IMPACT ASSESSMENT SHEET (2 Operation Phase)

No.	Activities/ Works		Impact Receptor														Justification & Mitigation Measures		
			Physical Environment					Biological			Safety		Social						
			Atmosphere	Surface Water	Underground water	Soil	Topography	Landscape	Flora	Animals/Reptile/Fish	Birds	People	Assets	Life/ Livelihood	Land use	Local economy		Cultural heritage	Liability/ Reputation
5	Employment	Direct & indirect																	<p>NRC will disclose the information for recruits to the public in order to provide fair and equal job opportunities to the people in the region.</p> <p>The project will create a new job opportunities in the region directly and indirectly. It will contribute to improve the life/livelihood of the local people continuously during operation phase.</p>
6	Material/Service procurement																		<p>The bulk materials for operation/ maintenance and related services will be procured from local markets. It will contribute to enhance related industries and business and activate economy of the region.</p>

Table 7.3 HSE AND SOCIAL IMPACT ASSESSMENT SHEET (3 Decommissioning/Abandonment Phase)

Project	Baiji Refinery Upgrading Project
Site	Baiji, Salahaldeen, Iraq
Project Phase	Decommissioning/ Abandonment

Impact Severity Categories		
High	Medium	Low
H	M	L

No.	Activities/ Works	Impact Receptor															Justification & Mitigation Measures		
		Physical Environment					Biological			Safety		Social							
		Atmosphere	Surface Water	Underground water	Soil	Topography	Landscape	Flora	Animals/Reptile/Fish	Birds	People	Assets	Life/ Livelihood	Land use	Local economy	Cultural heritage		Liability/ Reputation	
1	Facilities demolition	Displacement of contents	L	L	L	L	-	-	L	L	L	L	-	-	-	-	-	L	The decommissioning plan will be established after the decommissioning schedule is decided. The methods of displacement and the procedure how to treat the contents displaced will be discussed in the plan in accordance with the laws and regulation of that time for mitigation of the possible impacts on HSE and social aspects.
		Demolition works	L	L	L	L	-	-	-	-	-	L	-	-	-	-	-	L	The works will be carried out properly in accordance with the demolition procedures including HSE measures.
		Equipment & vehicles operation	L	-	-	-	-	-	-	-	-	L	-	L	-	-	-	L	The equipment and vehicles will be maintained in good conditions to mitigate emissions of the exhaust gases. Low impacts on the air quality and ecology in the region is expected. Operation area and time are controlled properly to mitigate the probable impacts on the local people.
		Noise & vibration	-	-	-	-	-	-	-	L	L	L	-	L	-	-	-	L	The site is located in the Baiji Refinery area. The nearest residential area is approx. 3 km south from the site and the extensive tank farm is laid out in between the areas. Low noise impact on the local people and wildlife is expected. The construction workers will wear the suitable noise protection gear in compliance with the occupational safety and health procedure.
		Wastes	-	L	L	L	-	-	-	-	-	L	-	-	-	-	-	L	The decommissioning plan will estimate the inventories of the wastes and discuss the maximum reuse or recycle of the waste materials. The other wastes will be segregated properly according to hazardous and non-hazardous properties. The wastes are managed properly from generation to the ultimate disposal in accordance with the waste management plan (WMP) provided by the construction contractor. The WMP will be complied with the regulation of NRC and relevant laws of Iraq.

Table 7.3 HSE AND SOCIAL IMPACT ASSESSMENT SHEET (3 Decommissioning/Abandonment Phase)

No.	Activities/ Works		Impact Receptor															Justification & Mitigation Measures	
			Physical Environment					Biological			Safety		Social						
			Atmosphere	Surface Water	Underground water	Soil	Topography	Landscape	Flora	Animals/Reptile/Fish	Birds	People	Assets	Life/ Livelihood	Land use	Local economy	Cultural heritage		Liability/ Reputation
2	Transportation	Materials & workers	L	-	-	-	-	-	-	-	-	L	-	L	-	-	-	L	The construction contractor will develop the traffic management plan (TMP) consulting with the local community and related authority in the region. The TMP will specify the routes and time schedule as well as safety provisions for operation of the project vehicles.
3	Site restoration		✓	✓	✓	✓	-	-	✓	✓	✓	-	-	✓	-	-	-	✓	After demolition of the facilities, the site will be restored to the previous conditions. It will cause that the environmental conditions and wildlife habitats will be improved due to termination of the emission/discharge of the pollutants into the environment.
4	End of operation	Dismissal	-	-	-	-	-	-	-	-	-	-	-	L (M)	-	L (M)	-	L (M)	According to the end of operation, the people will lose the jobs at the refinery. NRC will disclose the information regarding the end of operation in the early time after decision of the plan. NRC will also discuss the measures for the maximum continuous employment of the people or job training for re-employment to the other industries.
		No more material procurement	-	-	-	-	-	-	-	-	-	-	-	L (M)	-	L (M)	-	L (M)	According to the end of operation, the related companies will lose the business. It will associate probable decline of economy of the region. NRC will disclose the information regarding the end of operation in the early time after decision of the plan in order to prevent the sudden change of the business environment of the region.

8 Environmental and Social Management System

8.1 Environmental and Social Management System

The implementation of the environmental protection measures including personnel health and safety (HSE measures) and social considerations in the project will be managed properly and effectively in accordance with the scheme developed in the environmental management system provided by NRC. Prior to operation of the FCC Complex, NRC will enhance and improve the current HSE management system and then the HSE plans for the FCC Complex will be integrated into the system.

The improved HSE management system (HSE-MS) for the upgraded Baiji Refinery shall be structured essentially in accordance with the international standards (ISO 14000 series for environmental management and OHSAS 18000 series for occupational health and safety management) or the equivalent practices widely introduced to the refinery sector in the world.

NRC is responsible for the environmental and social management of the project, ensuring that the mitigation measures committed are implemented and the performance complies with applicable legal and regulatory standards and the NRC's policy in all material respects.



Figure 8.1 HSE-MS Operation

The HSE-MS structure consists of for (4) basic management procedures, such as “Planning”,

“Implementation”, “Checking” and “Action” for further development based on the principles in the international standards and the international guidelines for the oil sector. The HSE-MS has the philosophy of continual improvement for both the HSE-MS and HSE performance through a cyclic management process consisting of several management elements shown in Figure 8.1 HSE-MS Operation.

- Leadership and commitment
Senior management will set and commit the HSE policy and conducts the employees for the related activities by top-down.
- Policy and strategic objectives
In consideration of potential significant impacts, environmental goals and targets will be set.
- Organization, resources and documentation
The HSE management team will be organized in the project organization with sufficient staffs and budget for sound HSE performance. Managing manual and operational procedures will be documented.
- Evaluation and risk management
The company should maintain procedures to identify HSE hazards and to evaluate and control HSE risks by developing risk reduction measures for all activities, products and services.
- Planning
HSE plans will be developed for the implementation of HSE actions including mitigation and protection measures.
- Implementation and monitoring
HSE measures will be implemented in accordance with the HSE plans and the performance will be monitored continuously or regularly. Corrective action will be made according to the result of the monitoring, if necessary.
- Auditing and reviewing
Periodically, the senior management will conduct an audit and review the system performance and effectiveness of the measures undertaken. Further improvement of the HSE-MS will be discussed according to the findings of the audit and review. The results will be fed back to the HSE policy, strategy and plans appropriately.

The project HSE-MS provides a sound context for mitigation and monitoring of environmental and social management matters within the construction and operational phases of the project. For the construction phase, the construction contractor will provide a proper construction HSE-MS to achieve the goals of the project in compliance with the HSE policy and strategy of

NRC.

NRC will organize the environmental and social management team in the project organization comprising with sufficient staff and budget to manage and monitor the project HSE and social performance including all contractor's activities.

8.2 HSE and Social Plans

The project will establish the functional HSE and social plans including the protection and mitigation measures which address the respective HSE and social aspects assessed by the EIA exercise in the subsequent phase. In the construction phase, the construction contractor will provide the plans to be applied to the construction activities upon approval of NRC, and NRC will provide the plans for operations of the facilities in the operation phase.

Construction phase

- Land acquisition Plan (including compensation)
- Re-settlement Action Plan /Abbreviated Re-settlement Plan (if necessary)
- Environmental protection plan (gas emissions, water quality, noise and vibration)
- Waste management plan
- Transportation and traffic management plan
- Construction camp management plan
- Safety management plan
- Incident management plan
- Employment and training plan
- Environmental and social monitoring plan
- Information disclosure and consultation plan
- Community liaison plan

Operation phase

- Environmental protection plan (Gas emissions, water quality, noise)
- Waste management plan
- Traffic management plan
- Safety management plan
- Incident management plan
- Information disclosure and consultation plan
- Public relation plan
- Employment and training plan
- Environmental and social monitoring plan

The each plan shall define the objective and target, organization and responsibility, effective procedures for implementation of the plan as well as record and report.

8.3 Environmental Monitoring Plans

The environmental monitoring to be implemented as part of the HSE-MS activity aims to

- Verify compliance of the operation and HSE measures with the legislation, standards and other requirements,
- Assess the environmental impacts/changes by the operations, and
- Evaluate the effectiveness of the mitigation measures undertaken.

The comprehensive HSE monitoring plan covering the entire operations of the Baiji Refinery will be developed in accordance with the strategy of HSE-MS. The subjects for the monitoring include the respective HSE and social aspects such as

- Environmental pollution and mitigation measures (gas emissions and air quality, wastewater discharges and water quality, noise, waste management)
- Ecological conditions (diversity and habitats)
- Occupational health and safety performance (numbers of diseases, injuries, fatalities)
- Social performance (grievances from the community, social programs)

The cumulative impacts of the air emissions, wastewater discharges and noise as well as ecological diversity in the region shall be subject to the monitoring.

The monitoring plan will define the items and parameters of the subjects, monitoring methods, monitoring points and frequencies, records and the authorization of the results.

The results and findings of the monitoring shall be used properly for review of the HSE and social plans for further improvement of the HSE-MS of the refinery.

8.4 Incident Management Plan

During operation, there is a possibility for various incident or accident to occur at the facilities such as fire, explosion, oil spill, toxic gas release as well as injury or fatality of the personnel at the site or neighboring residents. Such emergency event may be caused by unexpected defect or damage of equipment, control malfunction, improper work procedure, third party sabotage, natural disaster and others.

NRC has a functional emergency plan for responding to the incidents such as fire, oil spill and injury of the personnel in the existing refinery. According to the upgrading of the facilities of the refinery, NRC will correspondingly provide a comprehensive Incident Management Plan (IMP) that will include all the necessary preparedness for the incident and response actions to be undertaken for protection of the personnel, environment and assets in the entire refinery facilities.

In case of massive release of harmful or toxic gases from the refinery due to defective operation of the facilities, the gas emitted into atmosphere will affect potentially the health of the people in the area depending on the weather conditions. In order to assess the risk and the impact of the occurrence on the local residents, NRC will conduct the modeling study for the gas dispersion for prediction of the extent of the affected area and the possible concentrations of the harmful or toxic gas in the air at the residential area. Such findings of the study shall be reflected to the IMP to be developed for the refinery.

The oil spill from the equipment, oil tanks or oil pipelines is one of the possible incidents during operation of the refinery. The oil spilled on the ground will cause the environmental impacts such as pollution of the soil/land, pollution of the adjacent water bodies i.e. river, swamp, lake and underground aquifer in the area, if any effective protection measures are not undertaken at the site.

The IMP shall be developed properly based on the risks of such emergency events and the predictive impacts on the environment, personnel health and safety, facilities as well as the local community in accordance with the possible scenarios of the event.

The IMP shall consist of the tiered emergency response plans depending on the severity and consequence of the event, the organization and responsibilities, internal and external communication procedure, capable resources (personnel, equipment and materials) necessary for execution of the plans. In addition, the medical services for the personnel, supports from the external organization and recovery procedures of the environmental and operational damage due to such event are included in the IMP.

9 Conclusions and Recommendations

In accordance with the discussions in the above sections, the conclusions of the preliminary Environmental Impact Assessment (EIA) implemented in this phase of the project and the proposed HSE and social items to be discussed and conducted in the subsequent project phases, i.e. FEED, EPC and operation, are described herein under.

9.1 Conclusions

The preliminary EIA exercise carried out in this phase concludes that the potential environmental and social impacts of the project activities in the respective project phases are expected to be mitigated properly in compliance with the requirements of the relevant laws and standards in Iraq and the applicable international guidelines through implementation of the environmental and social measures discussed in the study. The conclusions are summarized as follows.

The outcomes of the exercise are also outlined indicated in the environmental check list attached in the appendix, which is specified by the environmental and social guideline of JICA/JBIC.

9.1.1 Physical Environment

(1) Air Emissions

In the construction phase, the well maintained construction equipment and vehicles mobilized for the works will reduce the emissions of the pollutants in the exhaust gases. Proper dust prevention measures such as water spraying and soil control will be provided at the site.

The combustion equipment such as heaters, boilers, diesel engines, flare stack, etc. in the FCC Complex will be specified to comply with the standards for the emission of the harmful substances in the flue gas required by the relevant laws and/or the international guidelines. The closed oily drain system and vent gas system designed in accordance with the international practices will reduce the fugitive VOCs from the facility into the air.

It is expected that these measures will contribute to mitigate the impact on the air quality of the area in both the construction and operation phases of the project.

(2) Water Quality

The wastewater discharged by the construction activities will be properly controlled and flowed out to the existing drainage system of the refinery. The oily wastewater and the other wastewater

discharged from the process and other facilities will be collected and treated by the wastewater treatment system provided in the FCC Complex in accordance with the water quality standards specified by the NRC which complied with the relevant laws and the international guidelines. The treated water is then discharge to the Tigris River through the water canals around the refinery. Therefore, such wastewater treatment system proposed in the FCC Complex is expected to sufficiently mitigate the impact on the water quality of the Tigris River.

(3) Noise

The project site will be located at the designated facilities area in the existing Baiji Refinery and the nearest residential area, the most sensitive area to the noise emitted from the construction and operation of the facilities, is located at approximately 3 km south from the project site. The extensive tank farm is laid out in between the plant area and the southern boundary of the refinery, which will buffer the noise from the facilities. The project will specify the source equipment of large noise to be equipped with the proper protection devices such as silencer, enclosure, housing, etc. so as to comply with the standards of the noise in the residential area.

According to the above site location and the protective measures, the noise in the nearby residential area is expected to be mitigated to the acceptable levels.

(4) Wastes

The construction and operation of the FCC Complex will generate large amount of various wastes. In order to manage and treat/dispose the wastes properly, the construction contractor and NRC will develop the dedicated waste management plans respectively according to the categories of the wastes in accordance with the laws/regulations of the country and the applicable international guidelines.

Proper implementation of the waste management plan in each project phase will contribute to mitigate the potential impact of the wastes discharged from the project.

9.1.2 Ecology

The proposed FCC Complex will be located at the area prepared for future expansion in the boundary of the Baiji Refinery. Accordingly, the construction works including site preparation will not have direct impacts on ecology in terms of loss or damage of the wildlife habitats of the area. The proper protective measures for the gas emissions and wastewater discharges to the environment will mitigate the probable degradation of the environmental qualities of the habitats.

Therefore, it is expected that the project will not create significant impact on the ecological diversity in the region from the construction and operational activities.

9.1.3 Socio-Economic

As described above, the major project activities such as the construction of the FCC Complex will be limited within the boundary of the existing Baiji Refinery. Therefore, the project will not need any land acquisition and the resettlement of the residents for the construction of the proposed facilities. On the other hand, the project will create a new employment opportunities in the local community and promote various related businesses and services in the region. These activities will contribute to activate the local and regional economy and improve the life and livelihood of the affected communities accordingly.

In order to mitigate the potential impact on the community, NRC will develop the suitable social management plans addressing the possible disturbances to the life and social activities of the local people arising from the project and operational activities of the refinery.

9.1.4 Personnel Safety and Health

For assurance of the facilities safety, the international standards and practices as well as the procedure for the risk analysis recognized by the refinery sector in the world will be applied to the engineering and design of the proposed facilities. NRC will develop the safety procedure addressing the operational and maintenance works of the new facilities including the consideration for the conditions/environment of the work places, protection measures, permit to work system, training, etc. In addition, NRC will provide the incident management plan to response properly and effectively on the unexpected emergency event possibly occurred during operation of the facilities.

These considerations will contribute to mitigate the risk of the personnel safety and health associated with the project.

9.1.5 Cumulative Impacts

The proposed FCC Complex will be operated together with the existing refinery plants in the Baiji Refinery, so that, the cumulative environmental impact derived from the entire operations of the Baiji Refinery consisting of the existing and new facilities shall be assessed adequately.

According to the environmental monitoring records of the existing Baiji Refinery, both the air quality at the boundary of the refinery and the water quality of the wastewater discharged from the

refinery are well within the requirements of the relevant standards. The environmental protection measures for air emissions and water quality of the proposed FCC Complex will be developed appropriately in compliance with the applicable laws of the country and the international guidelines.

Accordingly, it is expected that the cumulative impacts of the entire operations of the refinery will also satisfy the requirements. However, it is needed to predict the possible cumulative impacts of the respective environmental aspects on the sensitive areas of the region through the use of reliable modeling exercises in the subsequent phase of the project. The environmental aspects subject to the exercises shall include air emissions, water quality and noise at least.

9.2 Recommendation

9.2.1 Environment Impact Assessment (EIA)

The preliminary EIA (this document) for the project has been drawn out preliminarily based on the project plan developed primarily by the conceptual design of the proposed FCC Complex and the limited information and data collected by the literature investigations for the environmental and social baselines of the project region without any site survey. The potential environmental impacts derived from the project activities and operations were assessed primarily and qualitatively using such limited information so as to scope the HSE items to be focused in the subsequent phase of the project.

For further assessment of the potential impacts identified by this EIA, the items to be undertaken by the EIA study in the subsequent phase of the project are proposed below.

(1) Identification of the project

As pointed above, the project description was provided primarily based on the conceptual design of the proposed FCC Complex. Accordingly, the configuration of the FCC Complex and specifications of the equipment comprising the facilities have not been decided exactly and the inventories of the waste substances such as gases, wastewater, solid and liquid wastes discharged from the facilities were not estimated properly yet in this phase.

The project feature i.e. facilities configuration, specifications of the equipment, operations and quantitative inventories of the wastes substances such as gases, wastewater, solid and liquid wastes and others discharged from the facilities as well as construction procedures shall be identified exactly as source of the impacts in accordance with the basic design of the facilities and equipment provided in the FEED phase of the project.

(2) Environmental and social baseline survey

For proper assessment of the project's impact on the environment and social aspects, it is essential to understand exactly the current environment and social status of the project region as receptors of the impacts. The information and data required for further environment and social assessment shall include, but not be limited;

- Weather conditions : Ambient temperature, humidity, wind data, rain falls, etc.
- Air quality in the region : Nearby residential areas
- Water quality of the Tigris River
- Noise levels : Nearby residential areas and the boundary of the refinery
- Ecological status : Vegetation and wildlife on land, river marshes and river including endangered species
- Social status : Population, life, jobs, industries, etc in the region
- Stakeholder of the project in the region
- Land owners and users along the proposed water transfer pipeline from the new water intake station to the refinery

The above baseline information shall be collected through the investigation of the latest literatures issued by the related institutes or organization and from the actual field survey by the research firms, laboratories or experts in the region as well as through consultation with the related communities.

(3) Environmental modeling studies

It was impossible to predict correctly the impact of the gas emissions from the facilities by the qualitative assessment in this phase. Based on the nature of the source and inventory of the gas emitted from the facilities, the concentrations of the harmful substances in the gas at the sensitive areas can be predicted by the numerical gas dispersion modeling study. Similarly, the expected noise levels at the nearby residential area that will be emitted from the facilities are also predicted by the modeling.

These modeling studies will provide the data for quantitative assessment of the impacts of the gas

emission and noise on the sensitive areas such as residential areas, and wildlife habitats in the potentially affected region. The same methods shall be applied to the assessment of the cumulative impacts of the gas emissions and noises from the entire refinery in the operation phase.

In addition to the above, the modeling study for the wastewater dispersion shall be also applied to the quantitative assessment of the possible impact on the water quality of the river.

(4) Re-assessment of the environmental impact

According to the findings of the above investigation and the studies, the environment and social impact of the project shall be re-assessed dedicatedly and the results shall be fed back to the engineering and design of the facilities and discussions of the further mitigation measures in the FEED phase of the project.

9.2.2 Environmental and Social Management System

(1) Environmental management system

The implementation of the environmental protection measures including personnel health and safety (HSE measures) and social considerations in the project will be managed properly and effectively in accordance with the scheme developed in the environmental management system provided by NRC. Prior to operation of the FCC Complex, NRC will enhance and improve the current HSE management system and then the HSE plans for the FCC Complex will be integrated into the system.

The improved HSE management system (HSE-MS) for the upgraded Baiji Refinery shall be structured essentially in accordance with the international standards (ISO 14000 series for environmental management and OHSAS 18000 series for occupational health and safety management) or the equivalent practices widely introduced to the refinery sector in the world. The framework of the HSE-MS includes;

- HSE policy and goals/targets
- HSE plans and measures/procedures
- Organization and resources
- Responsibilities for implementation
- Documentation including HSE plans, manuals, procedures, etc.

The HSE plans and procedures which address the respective HSE aspects shall be established properly to ensure that the HSE policy and the goals/targets of NRC are achieved seriously in the operations of the refinery.

(2) HSE and Social Plans

The project will establish the functional HSE and social plans including the protection and mitigation measures which address the respective HSE and social aspects assessed by the EIA exercise in the subsequent phase.

The plans will consist of, but not be limited,

- Pollution mitigation plans i.e. gas emission, water quality, noise, etc.
- Waste management plan
- Occupational health and safety plan
- Traffic management plan
- Information disclosure and public consultation plan
- Land acquisition plan
- Re-settlement action plan Abbreviated Re-settlement Plan (if necessary)
- Others

In the construction phase, the construction contractor will provide the plans to be applied to the construction activities upon approval of NRC, and NRC will provide the plans for operations of the facilities in the operation phase.

The each plan shall define the objective and target, organization and responsibility, effective procedures for implementation of the plan as well as record and report.

It is noted that the public consultation plan shall include at least 2 times of the public meetings with the stakeholders at the scoping stage and after completion of the draft EIA report.

(3) Environmental monitoring plans

The environmental monitoring to be implemented as part of the HSE-MS activity aims to

- Demonstrate compliance with the legislation, standards and other requirements,
- Assess the environmental impacts/changes by the operations, and

- Evaluate the effectiveness of the mitigation measures undertaken.

The comprehensive HSE monitoring plan covering the entire operations of the Baiji Refinery shall be developed in accordance with the strategy of HSE-MS. The monitoring plan shall define the items and parameters of the subjects, monitoring methods, monitoring points and frequencies, records and the authorization of the results.

The cumulative impacts on the air quality, water quality and noise as well as ecological diversity in the region shall be subject to the monitoring. In addition, the health and safety performance of the operation and the social aspect shall be also included in the monitoring plan.

(4) Incident management plan

NRC has a functional emergency plan for response to the incidents such as fire, oil spill and injury of the personnel in the existing refinery. According to the upgrading of the facilities of the refinery, NRC will provide a comprehensive Incident Management Plan (IMP) that includes all the necessary preparedness for the incident and response actions to be undertaken for protection of the personnel, environment and assets in the entire facilities.

The IMP shall cover the incidents such as fire and explosion, oil spill, massive toxic gas release, personnel injury and fatality and others, which are potentially occurred in the refinery.

The IMP shall be developed properly based on the risks of such emergency events and the local community shall be involved in the response plan, where necessary according to the risk analysis of the possible incident.

The IMP shall consist of the tiered emergency response plans depending on the severity of the event, the organization and responsibilities, internal and external communication procedure, capable resources (personnel, equipment and materials) necessary for execution of the plans. In addition, the medical services for the personnel, supports from the external organization and recovery procedures of the environmental and operational damage due to such event are included in the IMP.

According to the discussions for the HSE and social considerations for the project, the Terms of Reference for the formal EIA to be implemented in the subsequent FEED phase has been prepared in the appendix of this document, which describes the key items to be required for the EIA study and activities. In addition, the monitoring form to be provided by MOO/NRC during the respective subsequent phases is also attached in the appendix for reference.

APPENDIX

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
1 Permits and Explanation	(1) EIA and Environmental Permits	<p>① Have EIA reports been officially completed?</p> <p>② Have EIA reports been approved by authorities of the host country's government?</p> <p>③ Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?</p> <p>④ In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?</p>	<p>The preliminary EIA has been completed based on the conceptual design of the refinery in the feasibility study of the project. The formal EIA will be provided in the subsequent FEED phase according to the outcomes of basic engineering of the refinery.</p> <p>The preliminary EIA will be submitted to Ministry of Environment (MOEn) shortly for preliminary approval. The environmental plan (titled "Pre-EIA") for the project prepared by Ministry of Oil (MOO)/North Refineries Company (NRC) was approved by MOEn on July 5, 2009. (Ref. Pre-EIA 3.3.3)</p> <p>Refer to above.</p> <p>Refer to above.</p>
	(2) Explanation to the Public	<p>① Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public?</p>	<p>General project information is presented in the National Development Strategy of Iraq (2007-2010) established by the Government. Accordingly, the public understands the necessity and validity of the project generally. However, the details of the project information including the potential environmental and social impacts have not been disclosed to the public of the region in this planning phase.</p>

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Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		② Are proper responses made to comments from the public and regulatory authorities?	MOO/NRC will provide the practical scheme for information disclosure and public consultation for the project in subsequent phase upon the formal project approval of the government. (Ref. Pre-EIA 3.3.2)
2 Mitigation Measures	(1) Air Quality	① Do air pollutants, such as soot and dust (containing heavy metals, such as Ni and V), sulfur oxides (SO _x), nitrogen oxides (NO _x), and hydrogen sulfide emitted from various sources, such as boilers, furnaces, catalytic converters, coking units (thermal cracking units for residual oils), and other ancillary facilities comply with the country's emission standards? Is there a possibility that air pollutants emitted from the project will cause some areas to be not in compliance with the country's ambient air quality standards?	The project emission standards for air pollutants i.e. SO _x , NO _x , H ₂ S, PM, heavy metals, etc are specified properly in compliance with the requirements of the law and regulation of Iraq and IFC EHS guideline. Such standards will be applied strictly to the source equipment of the pollutants in order to ensure that the air quality in the project region is met satisfactorily to the ambient air quality standards of Iraq. In addition, for confirming the effect of the measures, NRC will establish the dedicated air quality monitoring program during the operation of the refinery, which includes regular measurement of the specific pollutants in the flue gases at the sources and ambient air quality at the air quality monitoring stations in the adjacent areas of the refinery. (Ref. Pre-EIA 3.3, 7.1.1, 7.2.1)
	(2) Water Quality	① Do pollutants, such as BOD, COD, oil and grease, phenols, benzene, and heavy metals contained in effluents (including cooling water) from various process units and other ancillary facilities comply with the country's effluent standards? Is there a possibility that the effluents from the project will cause some areas to be not in compliance with the country's ambient water quality standards?	The NRC has a strict water quality standards for the wastewater discharged from the facilities in the existing Baiji Refinery, which are complied with the values of IFC EHS guideline. The same wastewater standards will be also applied to the project. Accordingly, the proper wastewater treatment facilities consisting of the industrial effluent water, general drain water, sewage water treatment systems capable to comply with standards will be provided in the new FCC complex. (Ref. Pre-EIA 3.3, 7.1.1, 7.2.1)

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Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
2 Mitigation Measures		② Are adequate measures taken to prevent contamination of surface water and groundwater by these effluents?	<p>The wastewater from the process equipment and other contaminated drains are collected through a separated drain systems. The drain systems will prevent penetration of the pollutant into the ground. The treated water is discharge to the water canals around the facilities. Thus the wastewater is controlled from direct discharge to the Tigris River, and prevent contamination when the wastewater treatment system becomes defective accidentally.</p> <p>The water quality monitoring program will be established to ensure the proper operation of the treatment facilities and compliance of the treated water quality with the standards.</p> <p style="text-align: right;">(Ref. Pre-EIA 7.1.1, 7.2.1)</p>
	(3) Wastes	① Are wastes, such as organic compounds and hazardous wastes containing heavy metals (such as spent catalysts, collected dust, liquid wastes, and sludge) from various process units properly stabilized, treated and disposed of in accordance with the country's standards? Are non-hazardous wastes also properly treated and disposed of in accordance with the country's standards?	<p>NRC will establish the Waste Management Plan (WMP) for the project in accordance with the related laws of Iraq and the international guideline and practices. The WMP includes</p> <ul style="list-style-type: none"> - Inventory of the wastes generated from the project activities and operation of the refinery - Segregation: hazardous/ non-hazardous/ recyclable/ reusable, etc - Proper storage and transportation - Treatment and/or ultimate disposal - Waste tracking from generation to ultimate disposal <p>Details of applicable treatment/ ultimate disposal methods for hazardous and non-hazardous wastes will be developed in FEED phase in compliance with the laws and standards of Iraq and international guidelines.</p> <p style="text-align: right;">(Ref. Pre-EIA 3.3.2, 7.1.1, 7.2.1, 8.2)</p>

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
2 Mitigation Measures		② Are adequate measures taken to prevent contamination of soil and groundwater by leachates from the waste disposal sites?	<p>All the wastes discharged from the equipment are stored in the specific containers or facility (tanks, pit/pond) with penetration proof device according to the characteristics of the materials. Integrity of the storage equipment/facility will be inspected regularly in accordance with the facility maintenance program of the refinery.</p> <p>For the large waste storage pit, the monitoring wells for soil contamination will be provided as per requirement of the related regulation of Iraq and international guideline.</p> <p style="text-align: right;">(Ref. Pre-EIA 3.3.2, 7.2.1)</p>
	(4) Soil Contamination	① Has the soil in the project site been contaminated in the past, and are adequate measures taken to prevent soil contamination by leaked materials, such as crude oil, products, and chemical agents?	<p>The site for FCC Complex is the reserved area for future expansion of the facilities in the existing Baiji Refinery. The area has been vacant for a long time since the construction of original Baiji Refinery in 1978. Therefore, the soil in the area has not been contaminated by oil or any other pollutant in the past.</p> <p style="text-align: right;">(Ref. Pre-EIA 7.1.1)</p> <p>The proposed facilities will be designed properly to prevent accidental leaks/spills of oil or chemicals from the facilities in accordance with the international technical standards.</p> <p>The plant area will be paved with concrete or asphalt for protection of soil contamination. In addition, the secondary containment device called “Tank Dike” will be provided around the oil storage tanks for prevention of dispersion of the spilled oil.</p> <p style="text-align: right;">(Ref. Pre-EIA 3.3.2)</p>

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Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
2 Mitigation Measures	(5) Noise and Vibration	<p>① Do noise and vibrations generated by process unit operations comply with the country’s standards?</p> <p>② Is there a possibility that noise generated by large vehicle traffic for transportation of materials, such as raw materials will cause impacts?</p>	<p>The process and utility equipment of the refinery will have proper noise and vibration proof devices in accordance with related standards for protection of people. Level of the noise emitted from the facilities in the residential area will be controlled effectively in accordance with the noise standard of Iraq and IFC guideline. (The storage tank area is located in between the refinery and the nearest residential area, which effectively functioned as “buffer zone” of noise emission.)</p> <p style="text-align: right;">(Ref. Pre-EIA 7.2.1)</p> <p>In order to mitigate the probable noise impact on the local residents, NRC will establish the traffic management plan, which specifies the route and time limits for the heavy vehicle traffic from/to the refinery according to the results of the consultation with the community.</p> <p style="text-align: right;">(Ref. Pre-EIA 7.1.1, 8.2)</p> <p>The noise level will be monitored regularly in the residential area and along the main traffic route in the region. The findings will be reflected to the operations of the refinery appropriately.</p> <p style="text-align: right;">(Ref. Pre-EIA 7.2.1, 8.3)</p>
	(6) Subsidence	<p>① In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?</p>	<p>All the water to be used for operation of the refinery will be extracted from Tigris River. Therefore, groundwater extraction is not an issue.</p> <p style="text-align: right;">(Ref. Pre-EIA 4.3.6)</p>
	(7) Odor	<p>① Are there any odor sources, such as hydrogen sulfide and mercaptans originating from crude oil (especially sour oil containing relatively high levels of hydrogen sulfide)? Are adequate odor control measures taken?</p>	<p>H₂S and mercaptane included in the process fluid and product are eliminated suitably by the sweetening unit and de-mercaptan unit. NO_x in the flue gas, the other source of odor, is minimized by employing Low-NO_x type burners of combustion equipment such as boiler, furnace, etc.</p> <p style="text-align: right;">(Ref. Pre-EIA 4.3.5, 7.2.1)</p>

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
3 Natural Environment	(1) Protected Areas	<p>① Is the project site located in protected areas designated by the country’s laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?</p>	<p>The project site is located in the boundary of the existing Baiji Refinery. There is no protected area designated by the laws of Iraq and international treaties and conventions near the project site. The nearest national protected area “Wadi Tharthar Lake and Marshes” is approximately 50km south-west from the site and the Key Biodiversity area “Huweiija Marshes” is 40km north-east from the site, so that, the project will not cause any impact on the protected areas.</p> <p style="text-align: right;">(Ref. Pre-EIA 6.3.1)</p>
	(2) Ecosystem	<p>① Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?</p> <p>② Does the project site encompass the protected habitats of endangered species designated by the country’s laws or international treaties and conventions?</p> <p>③ If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?</p> <p>④ Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on</p>	<p>The project site is located in the boundary of the existing Baiji Refinery and there is no ecologically valuable habitat in the site.</p> <p style="text-align: right;">(Ref. Pre-EIA 4.3.1, 6.3)</p> <p>Refer to above.</p> <p>The Baiji Refinery is located at the plain 3km west from the Tigris River and the new water intake facility will be constructed on the bank of the river. The project will minimize the foot-print on the area with reed bushes for the construction of the facility.</p> <p style="text-align: right;">(Ref. Pre-EIA 4.3.1, 6.1)</p> <p>The industrial water for the refinery will be extracted from Tigris River. The location and method for extraction will be studied properly to minimize the possible impact on the water current and ecological habitat in the area.</p> <p style="text-align: right;">(Ref. Pre-EIA 4.3.6)</p>

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		aquatic environments, such as aquatic organisms?	
4 Social Environment	(1) Resettlement	<p>① Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?</p> <p>② Is adequate explanation on relocation and compensation given to affected persons prior to resettlement?</p> <p>③ Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?</p> <p>④ Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?</p> <p>⑤ Are agreements with the affected persons obtained prior to resettlement?</p> <p>⑥ Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?</p> <p>⑦ Is a plan developed to monitor the impacts of resettlement?</p>	<p>The new FCC Complex will be constructed at the designated area in the boundary of existing Baiji Refinery. In addition, the site for the proposed water intake facility and water transfer pipeline (7km long) will be selected at the rural area without any houses. Therefore, no involuntary resettlement will be caused by the project.</p> <p style="text-align: right;">(Ref. Pre-EIA 4.3.1, 4.3.6)</p> <p>Along the proposed pipeline route, further investigation will be conducted to confirm the probable uses of the land by the local people through the site survey and direct consultation with the local community in the subsequent FEED phase of the project. If any people, who uses the land for farming or grazing and the land has positive gains to their lives, are confirmed through the survey, the project will discuss dedicatedly the necessary compensations for them with the relevant authority of the region, regardless whether they are formal or informal land users.</p> <p>The project will develop the Land Acquisition Plan defining the procedure and formalities necessary for such acquisition of the land in accordance with the relevant legislation of Iraq and the environmental and social guideline of JICA/JBIC. Further, where the project is implemented under JICA ODA loan, the appropriate compensation for the owners/users of the land shall be discussed seriously between MOO/NRC and JICA to ensure compliance with the requirements of both the relevant law in Iraq and the environmental and social guideline of JICA/JBIC in the subsequent FEED phase.</p> <p style="text-align: right;">(Ref. Pre-EIA 4.3.1, 4.3.6, 7.1.3)</p>

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
4 Social Environment	(2) Living and Livelihood	<p>① Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?</p> <p>② Is there a possibility that large vehicle traffic for transportation of materials, such as raw materials and products will cause impacts on traffic in the surrounding areas, impede the movement of inhabitants, and cause risks to pedestrians?</p> <p>③ Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?</p>	<p>Since the project site will be limited within the boundary of the existing refinery area and the adjacent rural area, the possible adverse impact on the life and livelihood of the nearby residents will be minimized.</p> <p>On the other hand, the project is expected to create new job and business opportunities in the community during the construction and operation phases. Such activities will contribute in improving the life of the people and activating the regional economy (Ref. Pre-EIA 4.3.1, 4.3.6, 7.1.3, 7.2.3)</p> <p>NRC will develop the proper traffic management plan for the mitigation of the possible impacts on the local traffic network by discussing with the community and the related authority in the region. The plan will specify the traffic routes and time limits for transportation of the project vehicles as well as safety measures. (Ref. Pre-EIA 7.1.3, 7.2.3, 8.2)</p> <p>The water necessary for operation of the facilities will be supplied from the Tigris River through the new water intake and transfer system separately from the water supply system for the public. The Tigris River has sufficient water flow volume to supply the industrial water to the refinery without any disturbance for the other consumers. (Ref. Pre-EIA 4.3.6)</p>
	(3) Heritage	<p>① Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?</p>	<p>The project site will be located mainly in the boundary of the existing Baiji Refinery and adjacent rural area. There is no historical and cultural heritage in the areas.</p> <p>Where any evidence is found in the new construction site, MOO/NRC will undertake the proper measures consulting with the community, institute and</p>

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
			<p>the related authority.</p> <p>There are three registered World Heritages, i.e. Ashur (Qal'at Sherqat), Hatra, Samarra, in the same and neighboring provinces, but these subject heritages are located at the areas more than 50 km far from the project site, so that, it is expected that the project activities will not cause any impact on such valuable sites.</p> <p style="text-align: right;">(Ref. Pre-EIA 6.4.4, 7.1.3)</p>
4 Social Environment	(4) Landscape	<p>① Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?</p>	<p>The new facilities will be constructed at the designated plant area in the existing Baiji Refinery. The distance of the new facilities from the nearest residential area is approximately 2km and there is an extensive storage tank farm in between the facilities and residential area.</p> <p>Accordingly, any additional impact of the new facilities on the local landscape will be extremely insignificant.</p> <p>The new water transfer pipeline will be buried completely in the ground. As such, the pipeline will not affect the landscape after completion of the construction.</p> <p style="text-align: right;">(Ref. Pre-EIA 7.2.3)</p>
	(5) working conditions	<p>① Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?</p>	<p>MOO/NRC demonstrates that the safety of people is the first priority of the project and operation. The project will fully applied the relevant laws and standards of Iraq to the project as well as the applicable international guideline including IFC EHS guidelines.</p> <p style="text-align: right;">(Ref. Pre-EIA 3.1, 3.3.2)</p>

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
4 Social Environment	(5) working conditions	<p>② Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?</p> <p>③ Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public sanitation) for workers etc.?</p> <p>④ Are appropriate measures being taken to ensure that security guards involved in the project do not violate safety of other individuals involved, or local residents?</p>	<p>NRC will develop the personnel health and safety plans to be applied to the construction and operation activities associated with the project in accordance with the requirements of the applicable laws of Iraq and international guidelines. (Ref. Pre-EIA 7.2.4)</p> <p>The occupational health and safety plans specify the safety procedure including the work permit system, wearing of personnel protective equipment (PPE), work procedure, handling of hazardous/toxic materials, safety driving and other health and safety measures as well as regular training. These health and safety plans will be applied equally to all the personnel involved in the project including contractor personnel. (Ref. Pre-EIA 7.2.4)</p> <p>Since the project site is limited in the boundary of the existing Baiji Refinery and the adjacent area, the access and contact of the local people to the project site and project personnel will be minimized. Baiji Refinery has been operated in the region continuously since 1978 and NRC has been maintaining a good relationship with the local community for a long time. NRC is expected to maintain such relationship during the construction and operation, too. (Ref. Pre-EIA 7.2.4)</p>

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
5 Others	(1) Impacts during Construction	<p>① Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?</p> <p>② If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?</p> <p>③ If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?</p>	<p>The construction contractor will provide the environmental protection plan for construction in accordance with the HSE policy and strategy of MOO/NRC and relevant laws of Iraq and the international guideline. The plan includes the measures as follows.</p> <ul style="list-style-type: none"> - Proper maintenance of the construction equipment and vehicles - Fixing silencers on the machines and vehicles - Dust prevention (sprinkling) - Wastewater, sewage treatment, storm water control, etc. - Waste management plan - Spill/leak prevention for oil, fuel, chemicals <p style="text-align: right;">(Ref. Pre-EIA 7.1.1)</p> <p>The construction site is located mainly in the boundary of the existing refinery area. Accordingly, the possible impacts of the construction on ecosystem in the region are mitigated. The above measure will contribute to mitigate further the potential indirect impacts on the environment of wildlife habitats in the surrounding area of the site.</p> <p style="text-align: right;">(Ref. Pre-EIA 7.1.2)</p> <p>MOO/NRC will establish the dedicated information disclosure and public consultation plan prior to commencement of the construction. The social plans related to construction such as the land acquisition plan, traffic management plan, etc. will be developed properly discussing with the local community and related authority in order to minimize the possible impacts on the community and prevent the probable conflicts with people.</p> <p style="text-align: right;">(Ref. Pre-EIA 7.1.3)</p>

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
5 Others		④ If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	The construction contractor will provide the health and safety plans which addressed the construction activities, including the occupational health and safety, traffic safety, safety work procedures, regular training program, etc. In addition, the construction camp management plan will be also provided for proper control of the life, health and hygiene of the construction workers. (Ref. Pre-EIA 7.1.4, 8.2)
	(2) Accident Prevention Measures	① Are adequate accident prevention plans and mitigation measures developed to cover both the soft and hard aspects of the project, such as establishment of safety rules, installation of prevention facilities and equipment, and safety education for workers? Are adequate measures for emergency response to accidental events considered?	To ensure the safety and integrity of the operation, the advance international standards and practices will be applied to the engineering and design of the facilities and safety/control systems and the suitability/soundness of the design will be verified through the risk assessment technique i.e. HAZID, HAZOP, QRA, etc. The comprehensive facilities maintenance plan will be developed to ensure that the facilities and equipment are maintained in good conditions without any defects which could cause the crucial accident. (Ref. Pre-EIA 7.2.4) NRC has the functional emergency plan for responding to the possible accidents such as fire, explosion, oil spill, etc. in the existing refinery. NRC will develop the comprehensive Incident Management Plan (IMP) for addressing the emergency situations that could possibly happened in the entire Baiji Refinery including new FCC Complex. The IMP will consist of the emergency preparedness (emergency organization, response procedure and resources, etc.) and periodical training and exercise for all the personnel involved in the operations. (Ref. Pre-EIA 8.4)

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
5 Others	(2) Accident Prevention Measures	② Are adequate accident prevention measures (e.g. installation of prevention facilities and equipment and establishment of prevention management framework) taken for storage, loading/unloading, and transportation of hazardous and dangerous materials?	<p>The storage tanks for crude oil, products and other hazardous materials are designed and installed properly in compliance with the relevant laws and regulations of Iraq and the applicable international standards and guidelines for prevention of the leaks due to potential defects and fire/explosion.</p> <p>The area of storage tanks is designated as “Hazardous Area”, and the works associated with the source of ignition are strictly restricted for mitigation of the risk of fire.</p> <p style="text-align: right;">(Ref. Pre-EIA 3.3.2)</p> <p>These storage facilities provide the secondary containment (i.e. tank dike) with the specific capacity in the space according to the requirement of the laws and standard in order to restrict the diffusion of the material when spilled accidentally.</p> <p>In addition, the fire detection and fire fighting system is also provided on the tanks and the area of the facilities in accordance with the laws and standards.</p> <p style="text-align: right;">(Ref. Pre-EIA 3.3.2)</p>
	(3) Monitoring	① Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	<p>NRC will establish the Environmental Monitoring Plan (EMP) as part of the HSE Management System for operations of Baiji Refinery. The EMP aims to</p> <ul style="list-style-type: none"> - Verify compliance of the operation and HSE measures with the legislation, standards and other requirements - Assess the environmental impacts/changes by the operations - Evaluate the effectiveness of the mitigation measures undertaken

Environment Check List (Petroleum Refinery)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
5 Others	(3) Monitoring	② Are the items, methods and frequencies included in the monitoring program judged to be appropriate? ③ Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? ④ Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	The details of EMP will be developed properly in the subsequent FEED phase of the project in accordance with the requirement of the relevant laws and regulations and the environmental guideline of JICA. The EMP will specify the monitoring items and parameters, time and frequency, locations, methods, organization, resources including the equipment, materials and budget, and documentation (records and reports) according to the requirements of the authority. <p style="text-align: right;">(Ref. Pre-EIA 8.3)</p>
6 Note	Reference to Checklist of Other Sectors	① Where necessary, pertinent items described in the Ports and Harbors checklist should also be checked (e.g., projects including construction of ports and harbor facilities).	Not applicable.
	Note on Using Environmental Checklist	① If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, and global warming).	Not applicable

- 1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are made, if necessary.
 In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan' experience).
- 2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

**Proposed Terms of Reference (TOR)
For
Environmental and Social Impact Assessment (EIA)**

Baiji Refinery Upgrading Project

The Ministry of Oil (MOO) and North Refinery Company (NRC) of Republic of Iraq initiated the Baiji Refinery Upgrading Project (the Project) through additional construction of Fluid Catalytic Cracking (FCC) Complex for the purpose of immediate improvement of the expected future imbalance between demands and supplies of oil products for public consumption in the region. MOO/NRC plans to implement the project using the Official Development Assistance (ODA) loan from the Japanese Government through Japan International Cooperation Agency (JICA)

This document presents the key terms of reference for the formal environmental and social impact assessment (EIA) to be implemented in the subsequent front-end engineering and design (FEED) phase of the project.

1. Objectives

The objectives of the formal EIA to be implemented in the FEED phase of the project are described below.

- (1) To identify and assess the potential Health, Safety and Environment (HSE) and Social impacts in detail that could arise from the project activities covering all the phases of the project life cycle and to develop the effective preventive and/or mitigation measures to be implemented in the project
- (2) To integrate HSE and social considerations into the proposed project planning and operations of the facilities in the best available practical manner
- (3) To ensure the sustainable implementation of the protection and mitigation measures /plans proposed in the project for HSE and social aspects of all phases of the project
- (4) To maintain the HSE and social integrity of operations through dedicated assessment of the measures taken and their effects and sustainable improvement

2. Applicable Legislation, Standards and Guidelines

The EIA shall be implemented dedicatedly in compliance with the requirements of the legislation, standards and guidelines described below.

- (1) Environmental related laws, regulations and standards of Iraq
- (2) Operational Policies (OP), Bank Procedure (BP), Operational Directives (OD) and related guidelines of World Bank
- (3) Performance standards and EHS guidelines of International Finance Corporation (IFC)
- (4) JICA/JBIC^{Note} Environmental and Social Guidelines
- (5) International HSE and Social guidelines and practices (oil and gas industrial sector)

3. EIA Procedure

The EIA shall be implemented in compliance with the procedure and methodology required by the relevant law and regulation of Iraq and the related environmental and social guidelines of World Bank and IFC as well as JIC/JBIC. The typical EIA procedures to be applied are, but not be limited to, as follows.

- (1) Project definition
- (2) Environmental and social setting
- (3) Scoping and confirmation of key issues
- (4) Environmental and social baseline study
- (5) Identification of environmental and social impacts
- (6) Assessment of environmental and Social impacts
- (7) Discussion of protective/mitigation measures
- (8) Consolidation of EIA report

The EIA report shall consist of the descriptions, but not be limited to, at least as follows.

- (1) Executive summary
- (2) Project description
- (3) Project alternatives
- (4) EIA methodology
- (5) Policy and legal framework
- (6) Environmental and social baseline
- (7) Environmental and social impacts and assessment
- (8) Mitigation measures

^{Note} Japan Bank for International Cooperation

(9) Environmental and social management plans

(10) Conclusion

The EIA draft shall be submitted to the Ministry of Environment (MOEn) of Iraq for approval. The MOEn will review the EIA draft dedicatedly in accordance with the procedure specified by the regulation. (The procedure for EIA approval is under development at present.)

The EIA draft shall then be disclosed to the public through appropriate media available in the region and the consultation with the stakeholders shall be held throughout the preparation and implementation stages of the project. Having consultation is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared. Records of consultation meetings with affected people should be attached to EIA report. The EIA shall be finalized properly reflecting the results of the consultations, if applicable.

The EIA approved by the authority shall be further disclosed publicly during the specific period (120 days) prior to ODA Loan Agreement signing in accordance with the requirement of JICA Guideline.

4. Scope of EIA

The key HSE and social items to be discussed in the EIA are described herein under.

4.1 Project Definition

The following items shall be defined exactly as basic information of the project in accordance with the basic design of the facilities and project activities provided in the FEED phase of the project.

- (1) The project feature : facilities configuration, process, specifications of the equipment
- (2) Construction procedure and method of the facilities
- (3) Operations of the facilities
- (4) Inventories of the waste substances discharged from the project activities in the construction and operation phases of the project
- (5) Project management scheme (including environmental and social management organization)

4.2 Policy and Legal Requirements

The EIA shall verify and demonstrate the HSE and social policy and strategy of MOO/NRC and set the goals of the project according to the result of serious discussion with MOO/NRC.

The EIA shall also identify the latest HSE and social laws, regulations and standards of Iraq to be applied to the project as well as the specific procedure for the EIA approval of the authority. The environmental standards of the project shall be specified in compliance with the requirements of the applicable legislation.

Where numerical standards have not been specified by the Iraqi legislation or the Iraqi standards are significantly lower than the international norm, the following International guidelines and/or best practice should be applied to the project:

- The World Bank Group/ IFC, Environmental, Health and Safety (EHS) Guideline (2007)
 - General EHS Guideline
 - Industry-Specific EHS Guidelines (Petroleum Refining)
- World Health Organization (WHO) Guidelines for ambient air quality
- JICA/JBIC environmental and social guideline
- Guidelines published by the oil and gas industries (API, IPIECA, OGP, etc)
- Others specified by MOO/NRC

4.3 Environmental and Social Baseline Survey

For proper assessment of the impacts on the environment and social aspects, it is essential to understand exactly the current environment and social status of the project site and region as receptors of the impacts. The information and data required for further environment and social assessment shall include, but not be limited to, as follows:

- Weather conditions : Ambient temperature, humidity, wind data, rainfalls, etc.
- Air quality in the region : Nearby residential areas
- Water quality of the Tigris River
- Noise levels : Nearby residential areas and the boundary of the refinery
- Land/soil contamination
- Ecological status : Vegetation and wildlife on land, river marshes and river including endangered species
- Social status : Population, life, jobs, industries, land uses, etc. in the region

- Stakeholders of the project in the region
- Land owners and users along the proposed water transfer pipeline from the new water intake station and the refinery

The above baseline information shall be collected through the investigation of the latest literatures issued by the related institutes or organization and from the actual field survey by the capable research firms, laboratories or experts in the region as well as through consultation with the related communities.

4.4 Analysis of Alternatives

In order to verify the validity of the defined project plan, the EIA shall analyze the optional plans proposed in the planning and engineering phases. The study shall compare the characteristics of the alternatives. The aspects to be compared shall include the technical and economical advantages, operability and maintainability, productivity as well as the environmental and social effects associated with the project.

4.5 Environmental Impact Assessment

4.5.1 Environmental Pollutions

The harmful gas emissions, wastewater discharges, wastes, noise and vibration arising from the project activities shall be included in the environmental aspects subject to the assessment.

Based on the nature of the source and inventory of the gas emitted from the facilities, the concentrations of the harmful substances in the gas at the sensitive areas shall be predicted by the numerical gas dispersion modeling study. Similarly, the expected noise levels at the nearby residential area that will be emitted from the facilities and wastewater dispersion in the river are also predicted by the modeling.

These modeling studies will provide the data for quantitative assessment of the impacts of the gas emission and noise on the sensitive areas such as residential areas, and wildlife habitats in the potentially affected region. The same methods shall be applied to the assessment of the cumulative impacts of the gas emissions and noises from the entire refinery including the both existing and new facilities in the operation phase.

4.5.2 Ecological Impacts

According to the extent of the pollutants emissions, the EIA shall predict the areas affected by the project. The potential impacts of the project activities on the ecology including vegetation and wildlife in the project affected area shall be assessed in the study based on the findings of the baseline survey and the project activities in the construction and operation phases.

Where the endangered species are observed in the project site or adjacent area, the EIA shall assess the potential direct and indirect impact on the species. The mitigation measure shall be discussed with the experts of the institute in the field and the measures adopted from the discussion shall be reflected in the project plan properly.

4.6 Socio-Economic Impacts

The EIA shall assess the potential social and economic impacts in the region caused by the project. The socio-economic aspects to be assessed shall include the impacts on the life and livelihood of the residents including possible social unrest and conflict, economical effects as well as the expected employment opportunities in the region. In addition, the possible change of the landscape of the area and potential impact on the historical and cultural assets in the region shall be also included in the EIA.

The new water intake station is planned to be located at the bank in the upstream of Tigris River and the pipeline will be routed in parallel with the domestic road passing through the northern rural area of the refinery. The land for the water intake station and the right of way (ROW) for the pipeline will be acquired formally from the government in accordance with the legislation of the country.

The EIA shall define the land for the construction of the facility according to the facility plan developed by the basic design of the system and identify the owners and/or users of the land to be affected by the facility through the baseline investigation of the area and direct consultation of the residents in the region.

If any people, who uses the land for farming or grazing and the land provide positive gains to their lives, are confirmed through the investigation, the EIA shall discuss dedicatedly the necessary compensations for them with the relevant authority of the region, regardless whether they are formal or informal land users. The EIA shall develop the Land Acquisition Plan defining the procedure and formalities necessary for such acquisition of the land including compensation for the land owners/users in accordance with the relevant legislation of Iraq and the applicable social guideline of World Bank and JICA/JBIC.

4.7 Personnel Safety

The EIA shall assess the potential health and safety impact of the project on the personnel involved in the construction and operation of the facilities of the project and the residents in the project affected area. The study shall include the review of the hazardous situations of the work and harmful conditions of the work places in the construction and operation sites and the health and safety integrity of the protective measures to be undertaken by the project planning.

Furthermore, the possible health and safety impact on the people in the nearby community from the unexpected accident such as fire, explosion of the facility and massive toxic gas release from the plant shall be assessed dedicatedly using the advanced risk assessment technology.

4.8 Environmental and Social Management

4.8.1 HSE and Social Management System

The implementation of the HSE measures and social considerations in the project shall be managed properly and effectively in accordance with the scheme developed in the HSE management system provided by NRC. Prior to operation of the FCC Complex, NRC shall enhance and improve the current HSE management system and then the HSE plans for the FCC Complex shall be integrated into the system.

The improved HSE management system (HSE-MS) for the upgraded Baiji Refinery shall be structured essentially in accordance with the international standards (ISO 14000 series for environmental management and OHSAS 18000 series for occupational health and safety management) or the equivalent practices widely introduced to the refinery sector in the world. The EIA shall develop the framework of the HSE-MS in the study. The HSE-MS to be developed shall include;

- HSE policy and goals/targets
- HSE plans and measures/procedures
- Organization and resources
- Responsibilities for implementation
- Documentations including HSE plans, procedures, manuals, etc.

The HSE plans and procedures which address the respective HSE aspects shall be established properly to ensure that the HSE policy and the goals/targets of NRC are achieved seriously in

the operations of the refinery.

4.8.2 HSE and Social Plans

The EIA shall establish the functional HSE and social plans including the protection and mitigation measures which address the respective HSE and social impacts assessed by the EIA exercise in the FEED phase. The plans shall consist of, but not be limited to;

- Pollution mitigation plans i.e. gas emission, water quality, noise, etc.
- Waste management plan
- Occupational health and safety plan
- Traffic management plan
- Information disclosure and public consultation plan
- Land acquisition plan (including compensation)
- Re-settlement Action Plan/Abbreviated Re-settlement Plan (if necessary)
- Others

In the construction phase, the construction contractor shall provide the detail plans to be applied to the construction activities upon approval of NRC, and NRC shall provide the practicable plans necessary for the operations of the facilities in the operation phase.

Each plan shall define the objective and target, organization and responsibility, effective procedures for implementation of the plan as well as record and report.

These plans shall be established in compliance with the relevant laws and regulations of Iraq and the applicable guidelines of World Bank group and JICA/JBIC as well as the international practices of the same sector.

4.8.3 Environmental Monitoring Plan

The environmental monitoring to be implemented as part of the HSE-MS activity aims to;

- Demonstrate compliance with the legislation, standards and other requirements,
- Assess the environmental impacts/changes during the operations, and
- Evaluate the effectiveness of the mitigation measures undertaken.

The comprehensive HSE monitoring plan covering the entire operations of the Baiji Refinery

shall be developed in accordance with the strategy of HSE-MS. The monitoring plan shall define the items and parameters of the subjects, monitoring methods, monitoring points and frequencies, records, reporting system and the authorization of the results.

The cumulative impacts on the air quality, water quality and noise as well as ecological diversity in the region shall be subject to the monitoring. In addition, the health and safety performance of the operation and the social aspect shall be also included in the monitoring plan.

4.8.4 Incident Management Plan

NRC has a functional emergency plan for responding to incidents such as fire, oil spill and injury of the personnel in the existing refinery. According to the upgrading of the facilities of the refinery, NRC shall correspondingly provide a comprehensive Incident Management Plan (IMP) that will include all the necessary preparedness for the incident and response actions to be undertaken for protection of the personnel, environment and assets in the entire refinery facilities.

The EIA shall develop the IMP for the project, which covers the potential incidents such as fire and explosion, oil spill, massive toxic gas release, personnel injury and fatality and others.

The IMP shall be developed properly based on the risks of such emergency events studied in the basic engineering of the facilities and the local community shall be involved in the response plan, where necessary according to the risk analysis of the possible incident on the community.

The IMP shall consist of the tiered emergency response plans depending on the severity of the event, the organization and responsibilities, internal and external communication procedure, capable resources (personnel, equipment and materials) necessary for execution of the plans. In addition, the medical services for the personnel, supports from the external organization and recovery procedures of the environmental and operational damage due to such event are included in the IMP.

The IMP shall be developed in compliance with the requirements of the relevant laws and regulations of Iraq and the applicable international standards, guidelines and practices of the same sector.

4.8.5 Institutional Arrangement

The project shall provide the functional institutional arrangement in the project organization for assurance of the proper implementation of the environmental and social plans of the project.

Accordingly, the EIA shall clarify the following arrangement to be provided for the project in the study.

- (1) NRC : Organization Chart, Functional description, Number of Staffs, Job Description, (as for newly established section or newly employed staffs, Salary Structure, Qualification Standard should also be clarified)
- (2) Project Office : Organization Chart, Functional Description, Number of Staffs, Job Description, (as for the staffs employed under development budget, Qualification Standard, Man Month and Salary Structure should also be clarified)
- (3) Consultant, NGO etc: TOR (Scope of Work), Man Month schedule, Cost Break Down, Qualification Standard, Training Program

5. Schedule

The EIA shall be completed during the period of the FEED (15 months). The practicable schedule for implementation of the EIA shall include all the services specified by the final terms of reference developed properly by the MOO/NRC at the earliest time in the FEED phase and the period for the approval of MOEn.

In addition, the schedule shall consider the 120 days needed for the public disclosure period before ODA Loan Agreement signing required by the JICA Guideline. Therefore, the practicable schedule shall be developed properly according to the schedules of FEED activities and the expected date of the JICA ODA loan agreement for the project.

6. EIA Consultant

The EIA shall be implemented by a competent consultant capable of accomplishing all the services specified in the formal term of reference, which will be provided by MOO/NRC at the earliest time in the FEED phase. The consultant shall be selected fairly among the nominated consultant firms by MOO/NRC in accordance with the specific tender procedure.

The consultant selected shall be able to complete all the services seriously including the necessary assistance until the JICA ODA loan agreement has been finally consummated.

7. Cost Estimation

The EIA shall estimate the cost for the environmental and social considerations proposed in the study which is to be included in the budget for implementation of the project. The cost to be

estimated shall consists of the direct expenditures for the environmental and social measures to be undertaken, management and operational staffs of the project office, employment of consultants and the indirect expenditures necessary for the environmental and social activities for the project.

End

Environmental and Social Monitoring Form
For
Baiji Refinery Upgrading Project
(Proposal)

The project to be implemented under the JICA ODA Loan required that the environmental and social considerations of the project fully complied with the environmental and social guideline of JICA/JBIC as well as World Bank group/IFC. Therefore, JICA will monitor the proper execution and performance of the environmental and social measures being undertaking or undertaken by MOO/NRC in the respective subsequent phases of the project, i.e. Front-end Engineering and Design (FEED) phase, Engineering/Procurement/Construction (EPC) phase and Operation phase.

The items for the environmental and social monitoring are proposed preliminarily in this document in accordance with the findings of the environmental and social review in the conceptual design phase of the project. MOO/NRC is required to provide JICA with the necessary information for the above purpose in accordance with the table shown below.

Through this monitoring, JICA will be able to verify that the environmental and social considerations for the project are being implemented properly in compliance with the environmental and social guideline of JICA/JBIC as per the requirement of ODA loan.

Table: Monitoring Items for Environmental and Social Considerations

	Item	Time/Frequency	Method
1. FEED Phase			
(1)	Final TOR for EIA	Before tender for EIA consultant	Document review
(2)	EIA report	After completion of EIA	Document review
(3)	EIA approval by MOEn	After approval	Approval letter from MOEn
(4)	Result of public consultation and responses of MOO/NRC	After disclosure period	Document review
2. EPC Phase			
(1)	HSE & Social plans for construction - HSE & Social management plan/ manual - Environmental mitigation plan - Waste management plan - Social plan (including land acquisition plan) - Occupational health & safety plan - Incident management plan - HSE & social monitoring plan - Others	Before construction	Document review

	Item	Time/Frequency	Method
(2)	Environmental monitoring report - Air quality (Monitoring points in residential area) - Water quality (Tigris river) - Wastes management - Noise (Monitoring points along the boundary of refinery)	Every 6 months	Report review
(3)	Social monitoring report - Consultation records - Grievance and response records	Every 6 months	Report review
(4)	Safety performance report - Incident/injury records (Total recordable incident rate/ Lost-time injury frequency)	Every 6 months	Report review
(5)	Major incident report - Accident/ fire/ fatality/ others	Occasional	Report review
3. Operation Phase			
(1)	HSE & Social plans for operation - HSE & Social management plan/ manual - Environmental mitigation plan - Waste management plan - Social plan - Occupational health & safety plan - Incident management plan - HSE & social monitoring plan - Others	Before operation	Document review
(2)	Environmental monitoring report - Air quality (Monitoring points in residential area) - Water quality (Tigris river) - Wastes management - Noise (Monitoring points along the boundary of refinery) - Wildlife (bird, etc)	Once a year	Report review
(3)	Social monitoring report - Consultation records - Grievance and response records	Once a year	Report review
(4)	Safety performance report - Incident/injury records (Total recordable incident rate/ Lost-time injury frequency)	Once a year	Report review
(5)	Major incident report - Accident/ fire/ fatality/ others	Occasional	Report review

Note that the monitoring items for the EPC and operation phases and the details such as monitoring parameters, measurement method and formats of the report/record should be finalized appropriately at the beginning of each phase through discussion between MOO/NRC

and JICA in accordance with the outcomes of the formal EIA to be implemented in the subsequent FEED phase.

The reference is made to a sample of the applicable Environmental Monitoring Form attached herewith.

**Sample of Environmental Monitoring Form
for
Baiji Refinery Upgrading Project
(For Reference)**

1. Air Quality

(1) Ambient Air Quality

Unit: $\mu\text{g}/\text{m}^3$

Item		Monitoring Stations*				NRC Standards	IFC/WHO Guidelines
		No. 1	No. 2	No. 3	No. 4		
SO ₂	1hr Av					0.1ppm	-
	24hr Av					0.04ppm	20
	Annual Av					0.018ppm	-
NO ₂	1hr Av					0.05ppm	200
	Annual Av					0.04ppm	40
PM ₁₀	24hr Av					150	50
	Annual Av					-	20

Av: average

* To be located in the residential areas adjacent to the refinery

(2) Air Emissions

Unit: mg/Nm^3

Item	Emission Sources*				NRC Standards	IFC Guidelines
	Gas turbine Generator	Boiler	Furnace	SR Unit		
SO _x					-	500 (150 for SRU)
NO _x					-	450
PM					-	50
Vanadium					-	5
Nickel					-	1
H ₂ S					-	10

* Major emission sources in the refinery

SR Unit: Sulfur Recovery Unit

Note that NRC standards shall be defined in FEED phase

2. Water Quality

(1) Wastewater Discharge

Item	Discharge Points*		NRC Standards	IFC Guidelines
	Baiji Refinery	FCC Complex		
pH			6.5 – 8.5	6 - 9
BOD			30 ppm	150 mg/L
COD			150 ppm	30 mg/L
TSS			40 ppm	30 mg/L
Oil & Grease			10 ppm	10 mg/L
Iron			2 ppm	3.0 mg/L
Lead			0.1 ppm	0.1 mg/L
Nickel			0.2 ppm	0.5 mg/L
Mercury			0.005 ppm	0.02 mg/L
Sulfide			400 ppm	1 mg/L
Temperature			Less than 33°C	Increase < 3°C

* Treated water outfall points from the existing refineries and new FCC Complex

(2) Water Quality of Tigris River

Unit: mg/L

Item	Monitoring Points*		Iraqi Standards	IFC Guidelines
	No. 1	No. 2		
Color			Normal	-
Temperature			-	-
Suspended Solid			-	-
pH			6.5-8.5	-
Dissolved Oxygen			>5	-
BOD			<3	-
Chloride Cl ⁻			200	-
Phenol			0.005	-
Sulphate SO ₄ ²⁻			200	-
Nitrate NO ³			15	-
Phosphate PO ₄			0.4	-
Ammonium NH ₄ ⁺			1	-

* No. 1: Water intake point, No. 2: Down-stream of the wastewater discharge channel

3. Noise

Unit: dBA

Item	Monitoring Stations*				NRC Standards	IFC Guidelines
	No. 1	No. 2	No. 3	No. 4		
Daytime (07:00 - 22:00)					55	55
Nighttime (22:00 - 07:00)					45	45

* To be located in the residential areas adjacent to the refinery or along the refinery boundary

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