ENVIRONMENTAL ACHIEVEMENTS & INITIATIVES

AT

KUWAIT NATIONAL PETROLEUM COMPANY

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Kuwait National Petroleum Company, Kuwait
SYNOPSIS

Kuwait National Petroleum Company (KNPC) operates three Refineries with combined Crude oil processing capacity of 930,000 Barrels Per Stream Day (BPSD). Refineries were built / modernized over different periods to meet various environmental guidelines applicable at that time. Kuwait Environmental Public Authority (KEPA) came into existence in Kuwait in year 2001 & KEPA regulations came as law binding on all industries. However, KNPC Refineries exhibited concern for the environment much earlier and have undertaken programs to improve the Environment by systematic evaluation, audit & prevention measures.

KNPC has introduced Safety, Health & Environmental elements into its business policy with a view to formulate uniform goals and targets, and implement an environmental management program. A dedicated department, Safety, Health & Environment has been established to enhance the development.

KNPC is continuously demonstrating sound environmental performance through organizational commitment to a systematic approach.
INTRODUCTION

Kuwait National Petroleum Company (KNPC), K.S.C is a state owned oil company that operates three refineries in Kuwait with combined refining capacity of 930,000 barrels per stream day. Right from the inception, KNPC plays a significant role in encouraging the upgraded product quality and compliance with specifications available time to time through integrated various refining processes.

KNPC is continuously demonstrating sound environmental performance through organizational commitment to a systematic approach. Accordingly, KNPC introduced Safety, Health & Environmental elements into its business policy to sustain and improve the quality of the environment and human health protection.

A dedicated department i.e. Safety, Health & Environment was established within KNPC to emphasize the high degree of commitment towards environmental performance in refining and marketing operation to establish and maintain communication with internal & external parties. In search of excellence in the field of environment, KNPC management has committed to upkeep environment by establishing ISO 14001 (i.e. Environmental Management System).

KNPC is continuously upgrading the facilities in the refinery with various environment friendly projects to meet its environmental objectives in anticipation and to ensure ongoing compliance with national and/or international requirements. Kuwait local authorities as well as public community have appreciated our untiring efforts & deep-rooted concern in the environmental field and KNPC wishes to do beyond.
A summary of the environmental achievements & initiatives undertaken by KNPC are given below:

1.0 ACHIEVEMENTS:

1.1.0 BASE LINE EMISSION BENCHMARKING

1.1.1 Environmental Pathfinder Study

Environmental Pathfinder study for Shuaiba Refinery was carried out by M/s Shell Global Solutions to estimate & compare actual environmental performance of Refinery vs. Best Practices. The objective of the study was to identify the gaps and suggest possible options for further improvement in Environment related activities. Identified action items are being followed to bridge the gaps.

1.1.2 Procurement of Trailer mounted ambient air monitoring facility.

Trailer Mounted Ambient Air Monitoring station including analyzers along with associated tools was procured in 2003 to carry out the pollution survey in and around the refinery & marketing facilities to identify the probable pollutants. The analyzer is capable to measure CO, SO2/H2S, NO/NO2/NOx, THC and Dust data accurately. Dedicated PC is provided in the Station to download data for compilation and reporting.
This facility has helped KEPA for ambient air monitoring at different locations on need basis.

1.1.3 Ambient Air Quality Monitoring by KEPA

KEPA conducted Ambient Air Quality Monitoring (AAQM) program in and around Shuaiba Refinery before and after General Refinery Turnaround (GRTA) 2001. The survey aimed to establish the impact of Shuaiba Refinery operation on environment in its vicinity.

Study indicated that all pollutants were within the prescribed limits except NO2, which is being controlled by changing operating conditions.

**KEPA SURVEY AT GRTA- 2001**

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1.2 SO₂ Emission Reduction

1.2.1 Flare Gas Recovery Unit at Shuaiba Refinery

To reutilize the flared hydrocarbon through flare stacks, Flare Gas Recovery Unit was installed at a cost of 5.7 million KD and commissioned at Shuaiba Refinery in January 2002. Recovered Hydrocarbon Gases are used to supply fuel gas in the heaters after amine treatment.
Acid gas (H₂S) from amine regenerators is sent to Sulfur recovery Unit. Accordingly, potential SO₂ emissions through flare stacks are minimized. About 15 MMSCFD recovered hydrocarbon gases are reutilized in the heaters.

About 30 Long Ton/day reduction in SO₂ emission was achieved. In addition to reduction in emission levels, contribution to energy saving was 350 MMBTU/hr.

1.2.2 Oxygen Enrichment facilities & Reliability Improvement of Sulfur Recovery Plant at Shuaiba Refinery

Stringent environment regulations enforced upgraded product quality specification (i.e. low Sulphur Diesel quality). To meet revised diesel quality, operation of hydrotreating units at higher capacity and increased operational severity (i.e. deep desulphurization) of hydrotreaters helped to achieve the specification. This has resulted in additional acid gas generation. To handle this excess acid gas load the Sulfur Unit capacities were augmented at a cost of 6.42 MMKD for higher Sulfur recovery using Oxygen Enrichment Technology.

Major modifications were also carried out under this project to improve unit on-stream efficiency & ensure reliability, which is the area of concern from environment point of view.

The project was commissioned in April-04 on air mode.

1.3 SOLID WASTE HANDLING / MINIMIZATION

1.3.1 Disposal of spent catalysts from West Shuaiba Industrial Area

About 172,000 drums (equivalent to 36,000 tons) of Spent catalysts were accumulated over the years and lying idle since long at west Shuaiba
Industrial Area. These catalysts were exported outside Kuwait, through auction to an International contractor following Basel Convention / KEPA regulations.

Non-metallic catalysts from the yard have also been disposed off to Shuaiba Solid waste Reception & Treatment station managed by Public Authority of Industries and operated by M/s NCC (KEPA approved contractor). Area has been already cleared and shall not be used for storing any spent catalysts in future.

1.3.2 Segregation, Recovery & recycle of paper waste

To enhance the paper reuse, green baskets have been provided in the entire working place to segregate the reusable papers from other dumping materials. Active support & encouragement from all employees for paper recycling is observed and satisfactory. This has contributed to recover about 3 to 4 MT paper per annum for recycling.

1.4 WATER CONSERVATION

1.4.1 Reduction in water consumption & reuse of treated water

To achieve the optimum usage of national resources, KNPC made a prudent and continuous effort to conserve water. Water reduction of 20% has already been achieved against the potential 825 GPM water saving by enhancing good practices and implementation of simple modifications.
1.5 **ENVIRONMENTAL POLICY & PROCEDURES**

Following Environment Management Documents/Procedures have been developed for systematic approach towards environment management.

- SHE Policy (Refer attachment-1)
- Manual on Air Pollution Monitoring & Control
- Procedure on Monitoring of Waste water Treatment & Disposal
- Oil spill Response Plan (OSRP) for Refineries and Local Marketing
- Release/Spill Response Coordination Procedure between KNPC & PIC
- Procedure on Solid Waste Management
- Procedure on Environmental Communication
- Environmental Guidelines for Contractors
- Procedure on Environmental Impact Assessment Study
- Procedure on Environmental Aspect Identification at KNPC Facilities
- Guidelines for Deployment of Mobile Ambient Air Monitoring Station
- Register of Environmental Aspects
- Apex Manual for Environment Management System
- KNPC’s Environmental Legislative Register
1.6 **PROMOTION / AWARENESS PROGRAM**

1.6.1 **Campaigns to promote environment awareness**

To enhance the environmental awareness amongst employees / workmen, KNPC conducted several programs viz.

- Towards Cleaner Air
- Save our Sea
- Shuaiba Waste Administration Program (SWAP / WRAP)
- Water Conservation (ConWat)
- Green Bin campaign

Community development programs were also conducted at some of Kuwait Arabic schools to inculcate the environmental values among the school children.

2.0 **INITIATIVES**

2.1 **BASE LINE EMISSION BENCHMARKING**

2.1.1 **Emission Inventory Risk Assessment & Environmental Information Management system (EIMS) Project for three Refineries & Local Marketing (Baseline Emission Study by M/s KISR)**

KNPC in association with Kuwait Institute for Scientific Research (KISR) conducted an Environmental survey for all three refineries as well as Local Marketing with the following objectives:

- To evaluate the base line air emission from the Refinery
- To develop the Refinery emission inventory levels.
• To recommend possible Best Available Control Technology (BACT) for emission control.

• Develop automation system for emission reporting.

• Study health risks associated with emissions from KNPC refineries and identify monitoring requirements for development.

EIMS Software program integrated with process information system is under preparation and expected to be completed by end of the year 2004. Typical electronic display sample format is enclosed as attachment-2 & 3.

2.2. Environmental Management system

KNPC has prepared environmental objective based on significant aspects. KNPC has completed extensive work and is in the process of obtaining ISO 14001-certification, which is expected by the end of year 2004.

Potential benefits associated with the implementation of Environmental Management System include:

• Demonstrating environmental management

• Assuring customer satisfaction through high level of commitment complying international standards.

• Fostering development and sharing environmental solutions

• Enhancing image and market share.

• Maintaining good public/ community relations.
2.3 SO2 EMISSION REDUCTION:

2.3.1 Tail Gas Treating Unit at Shuaiba Refinery

To minimize the overall SO2 emission level and to improve the overall Sulfur Recovery to 99.5 wt% in the existing Sulfur Recovery Units (SRUs), tail gas treating unit will be implemented at an estimated cost of 16 MMKD and expected completion by January 2006.

About 50 MT/day SO2 emission reduction is estimated from Shuaiba Refinery with the implementation of this project.

Similar tail gas treating unit is also planned for MAA refinery to reduce overall SO2 emission.

2.3.2 Fuel Gas Desulphurization Facility at Shuaiba Refinery

Presently, Fuel gas used at SHU is a mixture of imported LP Lean gas supplemented by treated Refinery Off gases. Estimated combined Fuel Gas H2S content is about 400 ppm.

Imported LP Lean gas contains about 500 PPM H2S and therefore new Fuel Gas desulphurization facility is envisaged to meet KEPA norms related to SO2 emission from Gas fired Heaters/Boilers H2S in fuel gas. H2S in Fuel Gas (for Heaters/Boilers) as per K-EPA standard is 230mg per dry standard cubic meter (equivalent to 160 pomp H2S) maximum. Project is expected to be completed at the beginning of year 2007 (i.e. Jan 2007)

2.3.3 Heaters & Boilers Safety Up gradation Project

The objective of this project is to upgrade Safety/Combustion Instrumentation & Control to meet international standards & provide emission monitoring facilities for all Heaters/Boilers of Refinery. With the upgraded instrumentation & emission monitoring facilities the source
emission will be controlled. Typical SO2 emission level after implementing all the project is shown in the attached chart (Refer attachment-4)

2.3.4 AGRP Tail Gas Treating Unit Quench Tower modification at KNPC Mina Al- Ahmadi Refinery (MAA)

Existing AGRP Quench Tower at MAA is being modified to enhancing acid gas recovery thereby less air pollution by sending acid gases to SRUs.

2.3.5 Sweetening of Fuel Gas used in Gas Plant area at MAA Refinery.

After the completion of Ethane recovery project, H2S level in fuel gas will be reduced to 10-ppm level.

2.4 SOLID WASTE HANDLING / MINIMIZATION

2.4.1 Long term plan for Spent catalyst management in KNPC Refineries

KNPC generates about 7,000 MT (estimate based on 35,000 MT in 5 years) of metallic & non-metallic type spent catalysts every year. (This includes mainly used catalysts from reactors, molecular sieves from dryers, alumina balls & filter support materials).

As a step towards environment protection & safe disposal of spent catalyst generated in all three refineries, a long term strategic solution is being adopted to award the contract for spent catalyst handling and disposal. The contractor will handle the spent catalyst and dispose in an environmentally friendly manner after recovering heavy metals.
2.4.2 Remediation of TML system & Decontamination of MEA Vessels at SHU/MAA.

Leaded Motor gasoline (with the use of Tetra Methyl lead) was phased out in year 1998 and discontinued in Kuwait. Unused TML was available in stores and kept as redundant. Equipments such as MEA regenerator (old and newly replaced) having arsenic content was idled for long time.

KNPC has phased out environmentally unfriendly TML (Tetra methyl Lead) octane booster & also arsenic based corrosion inhibitor. It is proposed to decontaminate the / remediate the facilities associated with these additives/inhibitors.

In order to remediate the entire TML system & decontaminate the old MEA vessels in an environmentally friendly manner, expertise from renowned firms were received and tendered for disposal. Octel has been selected as a contractor for disposal at a cost of KD 542,000.

2.4.3 Removal, Handling & Disposal of Asbestos in all KNPC refineries

Adopting a proactive approach, KNPC has phased out all the asbestos available in and around the refineries including cooling towers, Workshops, Offices (i.e. false ceilings & partition boards) and car parking areas. Asbestos was sent to Shuaiba Solid waste reception & treatment station operated by M/s NCC for disposal in an Environmental friendly manner. Asbestos in Shuaiba refinery is removed completely and for the remaining two refineries removal is in progress. Expected completion of this project is by the end of year 2005.
2.4.4 Remediation of existing oily sludge pit at West Shuaiba
Industrial Area

A project is undertaken for remediation of old oily sludge pits &
surrounding contaminated areas at West Shuaiba Industrial Area. About 3.5
million tons of oil will be recovered from this facility and for reprocessing
in the refinery. This will eliminate the chances of ground water
contamination due to leaching of oil. Expected completion of this project is
by April 2006.

2.4.5 Sludge Treatment facility

Contract for supply, installation, operation and maintenance of
sludge handling facility at MAB area is nearing completion. This facility
will treat 10,000 Metric tons of oily sludge per annum and is expected to

2.5 WATER CONSERVATION:

2.5.1 Waste Water Treatment Facility

In order to comply KEPA effluent discharge criteria for various
effluents from the refinery and to meet international standards, existing
Waste Water Treatment facility at all three Refineries will be revamped.
Estimated investment for implementation of this project is 40 MMKD.

2.5.2 Installation of additional DAF unit at MAB Refinery

Additional DAF was provided to handle emergencies mainly during
unit upsets. In addition it is capable to handle the total refinery load in case
existing DAF is under maintenance. Estimated project cost of
implementation for this project is about 0.5 MMKD. Project is already
completed and is under commissioning / stabilization.
2.5.3 Ground Water study by KISR

KISR in agreement with KNPC will carry out a study for the underground water /soil contamination at refineries and Local Marketing sites. The objective is to study the extent of soil & ground water contamination and suggest remedial measures to decontaminate in a best possible manner.

2.6 OTHER ENVIRONMENTAL RELATED PROGRAMS

2.6.1 Phase Out of Halons

Kuwait being a signatory of Montreal Protocol on substances that deplete the Ozone Layer. Montreal Protocol directive is to phase out 50 % of Halon system by year 2005 and the balance by year 2010.

Phasing out of Halon systems replacement / up gradation of associated fire detection and alarm systems in KNPC refineries has been planned to comply the Montreal Protocol.

2.6.2 Particulate matter

To arrest the catalyst fines & dust releases through regenerator stacks in Fluid Catalytic Cracking unit at MAA, an Electrostatic Precipitator (ESP) will be installed to meet KEPA norms. Project is expected to be completed by April 2007.

2.6.3 Odorless Refinery Program

A new program is initiated during the year to develop plan to reduce fugitive hydrocarbon emissions and other emissions from refinery leading to odor.
2.6.4 Developing Green belt around refinery

Green belts are being developed around the refineries by increased tree plantations in and around the refinery area.

CONCLUSIONS

Kuwait National Petroleum Company has made strident efforts towards effective environment management for reduction in emission levels & waste generation in an environmental friendly manner. KNPC is confident to excel in these areas and do beyond by implementing various environmental friendly projects to safeguard environment.
## WE CARE FOR THE ENVIRONMENT

### Attachment- 2

#### Emissions From MAB Refinery Fuel Gas Process Heaters

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<th>CO (ton/yr)</th>
<th>VOC (ton/yr)</th>
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KNPC Process Heaters Emission Comparison

- SHU, 195,000 bbl/day
- MAA, 410,000 bbl/day
- MAB, 231,000 bbl/day

PM-10, SO2, CO, NOx, VOC