

Executive Summary

Engro Asahi Polymer and Chemicals Ltd. (EAPCL) owns and operates a polyvinyl chloride (PVC) production plant at Bin Qasim near Karachi. The company, formed in 1997, is a joint venture between Engro Chemicals Pakistan Ltd., Asahi Glass Company, and the Mitsubishi Corporation. EAPCL has planned to expand its existing production capacity from 100,000 tons per year (tpy) to 150,000 tpy. At the same, EAPCL also intends to install two facilities, an ethylene dichloride and vinyl chloride monomer (EDC-VCM) plant and a chlor-alkali plant. The production capacity of the EDC-VCM facility will be 230,000 tpy of EDC and 204,000 tpy of VCM. The production capacity of the chlor-alkali plant will be 107,000 tpy of caustic soda and 91,600 tpy of chlorine.

To facilitate the increase in production of the three units, expansion in the existing utilities of the plant will also be undertaken. The new facilities will be installed adjacent to the existing EAPCL PVC plant (PVC-1) located in the Bin Qasim Industrial Area, Karachi (see **Exhibit I**).

Policy, Statutory, and Institutional Framework

The Pakistan Environmental Protection Act, 1997 is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The key features of the law that have a direct bearing on the proposed project relate to the environmental assessment for development projects. The Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000 (IEE-EIA Regulations, 2000), prepared by the Pak-EPA under the powers conferred upon it by the PEPA, 1997 categorizes projects for IEE and EIA. Schedules I and II, attached to the IEE-EIA Regulations, 2000, list the projects that require IEE and EIA, respectively. The proposed project falls into the category that requires an EIA. The National Environmental Quality Standard (NEQS), first promulgated in 1993 and amended in 1995 and 2000, sets the gaseous emissions and liquid effluent limits from industrial sources.

The IFC and the World Bank require all projects funded by these agencies to be constructed and operated in an environmentally responsible manner. All projects that receive IFC funding must therefore comply with appropriate World Bank Group environmental policies and guidelines. As the project proponents are likely to seek funding from the IFC for the proposed expansion project, the EIA has been carried out to comply with both national and IFC guidelines. The key documents of the IFC are the Environment and Social Review Procedure (ESRP) and the IFC's Performance Standards on Social and Environmental Sustainability. The key World Bank document is the *Pollution Prevention and Abatement Handbook 1998: Towards Cleaner Production*.

The proposed project will meet the applicable regulatory requirements as laid down in the Pakistan Environmental Protection Act, 1997, its associated rules and regulations, and other laws as described above and also the requirements of the IFC as laid out in its policy, performance standards, procedures, and guidelines.

Project Description

The proposed activities would involve the relocation of an EDC/VCM plant and installation of a new chlor-alkali plant. The proposed EDC/VCM plant is being brought in from Baton Rouge Louisiana, USA. In order to support these new plants (EDC/VCM, chlor-alkali, and PVC) a new utilities plant with enhanced offsite facilities will be required. The main feature of this would be a 59MW combined cycle power plant.

The proposed project has two main parts, termed 'the Expansion and Backward Integration of Existing PVC Plant' comprises the setting up of the above mentioned plant and also bringing in a 6-inch-diameter, 6km-long transmission line from a sister company Engro Vopak Terminal Ltd. (EVTL). The EVTTL will act also as storage site for ethylene which will be transferred to the site via the above-mentioned transmission line.

During operation, the EAPCL plant will utilize several flammable, hazardous, and explosive chemicals, such as ethylene, VCM, chlorine, hydrogen, and natural gas. The production processes will also result in the production of some additional chloro hydrocarbons and greenhouse gases.

Project Location

The project will be installed adjacent to EAPCL's existing PVC plant in industrial estate at the Port Qasim in the Bin Qasim Town. Bin Qasim is the easternmost town of the 18 constituent towns of the greater metropolitan Karachi. The Port Qasim was built in the 1970's to relieve pressure on the Karachi Port and is today the second largest port of Pakistan handling about 35% of the nation's cargo imported by sea. A large industrial area, built over an area of 4,500 hectare (11,000 acres) surrounds the port. The project location is shown in **Exhibit I**.

Existing Plant Facilities and Operations

PVC polymer is made by forming vinyl chloride droplets in water by vigorous agitation. Polymerization is started using monomer soluble initiators or catalysts that breakdown to give the free radicals and hence initiate a free radical polymerization of vinyl chloride. Reactions are carried out at different temperatures to give different grades of product with the required molecular weight. Following the reaction stage the untreated monomer is recovered from PVC slurry and slurry is dried to produce a dry powder final product.

The VCM in the existing setup is transported from storage facility at Port Qasim to the PVC plant through a six inch diameter pipeline. The approximate length of the line is six kilometers. Approximately 300 tons per day of VCM is delivered to the plant. The VCM is stored in a single pressurized, spherical tank with a capacity of 3,500 cubic meter (m³).

Proposed Development Project

Expansion and backward integration of the existing PVC plant include the installation of following new units and facilities:

1. A new PVC plant to produce 50,000 tpy of polyvinyl chloride resin
2. A chlor-alkali plant to produce 107,000 tpy of caustic soda and 91,600 tpy of chlorine.
3. A used EDC-VCM plant to be relocated from USA of 230,000 tpy EDC and 204,000 tpy of VCM capacities
4. Additional utilities including power plant, cooling tower, Demin water and polished water trains etc.
5. A 6-inch diameter, 6 km ethylene import pipeline from EVTL

The main raw material for the project will be ethylene, which will be transferred to EAPCL from the storage site at EVTL through a pipeline. The new facilities at the plant are expected to be commissioned in December 2008.

Environmental Setting

Port Qasim Industrial Estate is located on the northwest edge of the Indus Delta system. The system is characterized by long and narrow creeks, mangrove forests, and mud flats. The site is located on the Gharo creek that runs west to east.

The climate of the project area can be broadly classified as moderate. The characteristic features are moderate temperatures, afternoon sea breezes in the hot season, and higher temperatures in the period from July to January than January to July in spite of the monsoon-rain.

The two principle sources of industrial emissions in the vicinity of the proposed site are the Pakistan Steel Mill complex and the KESC power station.

There is no freshwater body in the area and the groundwater resources are also not very developed. Papri Badel Nala, a non-perennial stream flows through the industrial zone. The stream that rises in the hills of Sindh Kohistan, north of Port Qasim, drains the torrential water from the hills into the Gharo creek. The seawater quality within the Gharo Creek is comparatively good, except in certain places where effluents are discharged directly from areas such as the *Bhains Colony* (Cattle Colony), Pakistan Steel Mills, and KESC Power Plants, and other parts of the Port Qasim Area. The Korangi Creek located west of Gharo creek, is polluted due to the effluent discharged directly from the fishing villages and industries located further northwards.

The natural setting of creek coastal ecosystem of the project area has been characterized by some common shrubs and grasses. According to Flora of Pakistan (1972) eight species of mangroves have been reported from Pakistan, however, only four continue to thrive. Several species of reptiles, birds, and terrestrial mammals inhabit the project area, wherever suitable habitats are found. No species found in the project area are of concern from the point of view of conservation.

There are no villages or residential colonies in the project area. The nearest human settlement from the proposed site is Goth Lal Mohammad which is 6.5 km north to the site. The *dargah* (shrine) of Noor Hasan Shah is located approximately at 4 km southeast to the site. Other settlements which lie in the north and northwest of the project area at

more than 7 km are Goth Lal Mohammad, Goth Mohammad Keserani and Pipri Colony. The port Qasim residential colony is located approximately 9 km northwest from the existing plant boundary.

Environmental Impacts and Mitigations

Potential impacts of the proposed project were identified through a formal system of scoping. This included public consultation in two phases. Assessment of potential impact of included defining criteria for determining significance, predicting of the magnitude of the potential impacts, identifying mitigation measures, evaluating of the residual impact, and identifying monitoring requirements.

Impacts Associated with Construction Activities

As the project will be constructed on a site that is already acquired, moreover, the site is in an industrial area and no residential areas are located within 6-km of the site, many of the typical construction related environmental issues will not arise. To minimize the impact, mitigation measures based on sound construction and environmental practices have been proposed. These cover construction noise, dust emission, vehicle and equipment exhaust, soil erosion, soil contamination, and traffic disturbance.

Impacts Associated with Plant Operations

The potential environmental impacts associated with the operation phase of the expanded plants and the ethylene import pipelines that are discussed in detail in the report are presented below with a summary of the conclusions.

Plant Noise

A detailed noise level simulation and noise monitoring will be carried out during the detailed design stage. If this modeling shows that the World Bank limit is exceeded at the plant boundary, mitigation measures will be undertaken. This may include reduction of noise at source or construction of noise-abatement wall.

Emissions

The main sources of gaseous emissions are the vinyl chloride and PVC powder from PVC plant; carbon monoxide, sulfur oxides, nitrogen oxides particulate matter hydrogen chloride and chlorine gas from the EDC-VCM plant, power plant and boiler; and chlorine and hydrogen gas from the Chlor-Alkali plant. Analysis carried out using USEPA SCREEN3 model shows that the ground level concentrations of all the pollutants will be well below the World Bank Limits.

Effluents

Effluent from the existing plant and utilities is treated in the exiting treatment plant to meet the NEQS and the IFC guidelines value. The treated wastewater is used for mangroves planted by EAPCL with the technical assistance from WWF-Pakistan. The treated effluent at discharge level is monitored and tested regularly to ensure its compliance with NEQS and the IFC guidelines value.

As demonstrated by the existing project, industrial wastewater treated to meet the NEQS and the IFC guidelines value can be used for plantation of mangroves. Mangrove plantation on additional areas will be carried out after the expansion of the plant.

Accidental Releases

Project operations will involve use of hazardous material in large quantities. These chemicals have a potential to harm human health and the environment around it if released accidentally into the atmosphere. A detailed risk assessment is carried out to assess the risk exposure of the population to hazardous levels of hazardous gases. Main gases which can affect the neighboring receptors in case of heavy leaks are chlorine, vinyl chloride, and ethylene. Chlorine and vinyl chloride will be stored in the storage tanks whereas ethylene will be supplied through a 6 inches diameter pipeline.

To assess the dispersion of the hazardous vapor cloud after it is released due rupture in the storage tank or the pipeline is United States Environmental Protection Agency's accidental release model SLAB is used. The model simulates the atmospheric dispersion of denser-than-air gases. Each emission scenario is simulated for four typical climatic conditions (two daytime and two nighttime) and two averaging time corresponding to the short-term (15-minutes) and long-term (8-hours) exposure limits. A separate simulation was also carried out to assess the zone in which the concentration of ethylene and vinyl chloride will be above the explosivity limit.

The consequence of an accidental release may include damage to the EACPL plant and the operators, in case of an explosion, fatalities in case of severe short term exposure, and various diseases such as cancer, disruption of the endocrine system, neurotoxicity, and immune system suppression. Of the three gases, the frequency of accidents for chlorine is the highest, whereas VCM is relatively the safer. The area that is most likely to be exposed to a potential VCM release is currently unoccupied so no serious threat to human life is envisaged. However, in future with the development of these areas the risk associated with the VCM/EDC manufacturing and handling processes will increase.

A detailed risk assessment will be carried out for the release of potentially hazardous gases from the plant. The existing emergency response plan will be expanded to cover the additional risks. Regular monitoring will be carried out to ensure that material of proper specification are used, leaks are detected in advance, periodic testing of material is carried out, and on-site detectors are operational.

Accidental Spills

Accidental discharge and leakages of oil or other chemicals may take place for which safety measures will be made part of the project design to minimize that occurrence of such events. A comprehensive contingency plan will be developed for accidental spill management.

Solid Waste Management

The increased waste generated due to the proposed expansion can potentially affect the environment. EAPCL has an effective waste management system which is regularly monitored and records are maintained. This practice will continue.

Community Development

Engro Asahi takes the development of community in which it operates very close to its heart. It is part of its core values which says that "we shall endeavor to improve the quality of life in the communities in which we live and operate." As part of the value, it commits about 1% of its profit after tax for work towards development of the society. It has encouraged locals for the jobs at the plant-site specially the contract workforce whose population is as big as the company's permanent employees.

Greenhouse Gas Emission

The estimated greenhouse gas emission from the plant will be 966,480 kg/day of carbon dioxide. The EAPCL expansion project envisages utilizing hydrogen gas from the chlor-alkali plant to supplement the natural gas fired in the ethylene dichloride cracking furnace. The combustion of hydrogen gas results in the release of H₂O (water vapor) into the atmosphere which is not a pollutant and does not result in the greenhouse effect. It is expected that hydrogen will result in savings of 0.8-1.0 MMscfd (million standard cubic feet per day) of natural gas.

Conclusion

This study was carried out to assess the environmental and socioeconomic impact of the proposed expansion and back integration of Engro's PVC plant at Bin Qasim. The assessment was carried out in keeping with the Pakistani legislation, as well as national and international guidelines.

It is concluded that if the field activities, including the implementation of all mitigation measures, are carried out as described in this report, the anticipated impact of the project on the area's natural and socioeconomic environment will be well within acceptable limits. The project will also comply with all the statutory requirements and standards.

To ensure implementation of the mitigation measures an environmental management plan for the construction phase will be prepared separately. EAPCL, as part of its core value, is committed to ensuring that the potential impacts of this project both on environment and socioeconomic climate are fully assessed. It has an elaborate Environmental Management System (EMS), certified and regularly audited by URS Pakistan for ISO-14001:2004. The existing EMS will govern the post-expansion operations as well. A preventive maintenance philosophy, supported by robust inspection plans and sound operational practices will be adopted to ensure sustainable and safe operation of the site.