ENVIRONMENTAL IMPACT ASSESSMENT OF CUU LONG FERTILIZER FACTORY, VINH LONG, VIETNAM.

PURPOSE

ETP1 COURSE TOPIC COVERAGE:

- ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCEDURES
- FULL-SCALE EIA
- CHALLENGES IN APPLYING EIA IN THE MRB
- INTEGRATED RESOURCE AND ENVIRONMENTAL MANAGEMENT (IREM) PRACTICAL TOOLS FOR IMPLEMENTATION
- ENVIRONMENTAL SCIENCE IN THE MRB
- ENVIRONMENTAL MONITORING

This case study examines the *post hoc* (i.e., occurring while the factory was already operational) application of environmental impact assessment (EIA) to an existing industrial activity in Vietnam to provide information on actual environmental impacts and the effectiveness of mitigation measures. Aspects of the EIA process examined are: (i) definition of the proposed development; (ii) the natural environment at risk; (iii) assessing the magnitude and significance of impacts to the environment; and (iv) deciding whether impacts are acceptable. Course participants will have the opportunity to evaluate the usefulness and effectiveness of the Cuu Long factory EIA with respect to:

- Disclosing to decision makers and the public the significant environmental effects of the factory's activities
- Identification of ways to avoid or reduce environmental damage
- Preventing environmental damage by requiring implementation of feasible alternatives or mitigation measures
- Public disclosure of the reasons for approving factory operations notwithstanding observed significant environmental effects
- Fostering inter-agency coordination
- Enhancing public participation

ISSUES

Specific issues highlighted by this case study are:

1. EIA's must be comprehensive and scientifically-defensible if they are to support well-informed decision making
2. The requirement to complete on EIA is an critical part of a government's environmental policy in terms of the protection and improvement of human quality of life and environmental health
3. EIA, if done correctly, is an important environmental management tool in predicting potential significant impacts and in determining how best to mitigate impacts in proceeding with a project or activity

4. Follow-up operational monitoring of projects and activities is essential in providing feedback on actual environmental impacts and in assessing the effectiveness of mitigative measures and the need for additional measures

LEARNING OBJECTIVES

As part of Vietnam's environmental protection policy, EIA's are routinely undertaken on existing activities or projects – which pre-date the requirement for conduct of an EIA in the planning stage – to determine whether they meet minimal environmental quality standards for continued operation. Although not directly comparable with the more comprehensive EIA's completed for new factories, the Cuu Long factory EIA does nonetheless provide some important learning opportunities for course participants.

On completion of this case study, participants will be able to:

- Identify environmental aspects of concern for this type of industry
- Identify potential significant environment issues (SEI) and valued environmental components (VEC)
- Quantify the observed environmental impacts of factory operations
- Describe the state of the local environment in the vicinity of the factory
- Evaluate the performance of monitoring programs undertaken by the factory and government agencies
- Discuss the appropriateness and effectiveness of existing mitigation measures
- Propose corrective actions available to the factory to further improve environmental quality
- List the pros and cons of undertaking an EIA during the operational stage, as compared to the planning stage, for a project or activity

PROJECT SUMMARY

Factory Location

The Cuu Long fertilizer factory covers a land area of 4.93 hectares of which 2.4 ha are devoted to the physical plant. As shown in Figures 1 and 2, the factory is bounded by a canal by the east, rice farming to the south (beginning 100 m away), the Co Chien River and national Highway 1 to the north, and Tan Hoa village, Vinh Long town to the west. Advantages of this factory location include:

- Close proximity of low-cost, time-effective river transportation
- Spacious factory site facilitating easy arrangement of raw materials receiving, production line, product shipping, waste treatment system, etc.
- Convenient for water supply and waste water discharges to and from the Co Chien River

- Removed from residential area thereby minimizing factory impacts to local populations

Receiving Environment Characteristics

Available monitoring data for sampling stations in the proximity of the Cuu Long factory indicates that receiving water and air quality is generally acceptable. Water quality parameters as measured by the provincial Department of Science, Technology and Environment (DOSTE) at Bac My Thuan on the Tien River are summarized in the following table.

pH	Color	Hardness (mg/L)	DO (mg/L)	COD (mg/L)	Fe (mg/L)	SO_4 (mg/L)	Cl (mg/L)	$N\text{-}NH^3$ (mg/L)
7.3	60	64	7.4	3.5	0.4	14	14.2	0.1

Air quality data dating from a 1996 DOSTE monitoring program near the Cuu Long factory are shown in the following table.

Dust (mg/m^3)	SO_2 (mg/m^3)	NO_2 (mg/m^3)	CO (mg/m^3)
0.46	0.07	0.05	1.0

Several variables are thought to influence the water and air quality in the vicinity of the Cuu Long factory. Dispersion and transformation process of pollutants in the receiving environment depend on the following meteorological factors.

Atmospheric Temperature

Temperature directly effects the transformation process of pollutants in the atmosphere with higher temperatures accelerating transformation resulting in a reduced retention time of pollutants in the atmosphere. According to the data collected from the Vinh Long meteorological station, annual temperatures are seasonally variable with higher temperatures occurring during the rainy season. The annual average temperature is 26.6 ^{o}C. Air quality is expected to be better during the rainy season as compared to the dry season.

Wind Speed and Direction

Wind is an important factor in the dissipation of the airborne pollutants; with greater dispersion occurring with higher wind speeds. Windy conditions are prevalent in Vinh Long –the meteorological station reports annual average wind speed of 2.6 m/s –resulting in generally good air quality in the vicinity of the Cuu Long factory.

Humidity and Rainfall

Although humidity has more limited affects on pollutant dispersion, some obstruction of air emissions can occur. According to the data collected from the Vinh Long meteorological station, the annual average humidity is 75 - 85%, with the higher humidity occurring during the rainy season. Rain can filter airborne pollutants from the atmosphere resulting in the deposition of pollutants to receiving water bodies such as streams, rivers and lakes.

Socio-Economic Characteristics

Local communities are dependent on the Cuu Long factory for employment and other needs. In excess of 60% of the workers in the factory live in two nearby villages. Tan Ngai villagers traditionally have lived mainly by rice cultivation and fruit tree planting. About 2/3 people of the village have an average or better living standard and have good houses. Most Tan Hoa village earn their living as labourers. Approximately 40% people of the villagers have an average living standard with the remainder having a lower standard of living. The factory provides employment to approximately 100 people earning an average salary of 600,000 VND/month. In addition, fertilizer produced by the factory has allowed local agriculture to develop.

By 1994, factory revenues were 18.9 billion VND annually with 180 million VND being paid in government tax each year.

Overview of Factory Activities

The Cuu Long fertilizer factory was constructed in 1977 and initially produced 40,000 tonnes/year of phosphorous fertilizer for agriculture using apatit and phosphoric powder as raw materials. In 1979, limestone was added as a raw material in the production of agricultural fertilizer. In 1987, production was changed again to the manufacture of super phosphorous but due to concerns about environmental pollution, the factory changed their technology to manufacturing mixed N, P, and K fertilizer. Production in 1989 was 12,000 tonnes.

Production of pellet fertilizers involves the grinding and mixing of raw materials such as urea, SA, DAP and potassium in different proportions depending on the type of fertilizer being made. The materials are first ground and then transported by conveyor belt to a mixing dish where they are combined by gravity feed into pellets. The finished pellets then exit the mixing dish and are carried by conveyor belt to the drying machine. After drying, pellets are then screened for size (4-6 mm) and transferred to the packing and storage warehouse awaiting shipment. Bigger or smaller size grains rejected by the screening machine are returned to the mixing dish for re-processing. Approximately 4% of raw materials (e.g., urea, SA, DAP and potassium) are lost during drying, packing and transportation.

Additional inputs to the production process are: electricity (10 KW for each tonne of fertilizer produced); and coal dust for the drying over (10 kg for each tonne of fertilizer produced. Since some products do not need to be dried, coal dust consumption varies with approximately 90 tonnes consumed each year.

Although not directly related to the production process, water use by factory workers constitutes an indirect input to production. Because there is no water supply system in the factory, water for domestic use by the factory workers has to be taken from the river. Water is first treated by sedimentation and filtration (sand, rocks, gravel) and then stored in three large tanks on the factory site. This water is used for cooking lunch for workers, and for their washing and bathing after working. Average daily water use is approximately 10 m^3.

Overview of the Factory's Impacts to the Environment

Negative impacts associated with factory operations encompass reduction of air quality, noise pollution, discharge of waste water containing contaminants to receiving water bodies, and solid wastes.

Air Quality Concerns

Sources of potentially damaging air emissions from the factory include:

- Dust and noxious fumes generated during production, loading and transport of fertilizer
- Burning of coal during the production drying process generating dust from coal storage, noxious fumes, and gas emissions (e.g., CO, NO_x, SO_x).

Monitoring results from the DOSTE sampling program conducted in June 1996 at stations both within the factory and in adjacent residential areas are shown in the following table.

PARAMETERS	STANDARDS (mg/m^3)		MONITORING RESULTS (mg/m^3)	
	IN FACTORY	RESIDENTIAL AREA	IN FACTORY	RESIDENTIAL AREA
Dust	6	0.5	2.9	0.57
SO_2	20	0.5	0.3	0.21
NO_2	5	0.085	0.075	0.061
CO	30	3	4.5	3

The monitoring results show that, for all parameters measured, applicable air quality standards were achieved with the exception of dust concentrations in residential areas which slightly exceeded the standard.

Noise Impacts

In the manufacturing process, noise is generated by grinding, mixing and pellet forming equipment, by overhead and ventilation fans, and by the conveyor system. Resulting ambient noise levels within the factory, if found to exceed the standards, have a negative affect on workers, making them tired, resulting in reduced ability to concentrate thereby reducing productivity and increasing potential for injury.

Noise levels measured by DOSTE during monitoring undertaken in April 1996 are shown in the following table.

MONITORING STATION	RESULT (dBA)	STANDARD (dBA)	
		IN FACTORY	RESIDENTIAL AREA
Mixing and pellet forming area	83	85	
Drying area	80	85	
Residential area (100 m from factory)	54		From 6-18h; 70 dBA From 18-22h; 65dBA From 22-6h; 55 dBA

These monitoring results indicate that noise levels both within and outside the factory met the applicable standards.

Water Pollution

Only low volumes of waste water are generated during manufacturing. Water use is limited to the pellet formation process where it is used to provide greater adhesion of the raw materials following grinding and mixing. Water use is approximately 2-3 m^3/day. No waste water is discharged directly to the receiving environment.

Because the majority of workers are local people they do not stay overnight at the factory. Waste water generated by day workers is mainly from cooking lunches, washing, and bathing. Water use is approximately 9 m^3/day. Waste water containing dregs, suspended solids, organic matter, nutrients and bacteria drains to a 30 m^3 holding pond where settlement and natural decomposition processes occur. Water is then discharged to the Co Chien River.

Solid Waste

Solid wastes generated during factory operations consist predominantly of polyethylene and polypropylene plastic bags; approximately 600 bags/day. The factory currently collects and recycles all plastics generated on the site. In addition to plastics, small quantities of organic solid waste are generated from domestic activities of staff staying overnight at the factory (e.g., on duty and security staff). Solid waste generated from kitchen and other domestic activities is landfilled on the factory site.

Factory Pollution Mitigation Measures

Mitigation measures currently being implemented at the factory are:

- Frequent cleaning of all factory equipment and surfaces to minimize air emissions
- Design of material and production storage systems to prevent dust release
- Planting of green trees around the factory
- Frequent inspection of worker protective equipment
- Periodic health examinations for workers
- Routine maintenance of noise generating equipment to minimize noise levels
- Periodic monitoring of environmental parameters in collaboration with DOSTE
- Preparation of an environmental management system for the factory.

Upgrades to factory equipment undertaken since the start of operations include: (i) extending the coal oven chimney to a height of 12 m to improve gas dilution process; and (ii) renewal of the dust treatment system to reduce dust emissions to nearby residential areas. Monitoring results following these renovations are shown in the following table.

MONITORING SITE	RESULT mg/m^3	STANDARDS mg/m^3	
		IN FACTORY	RESIDENTIAL AREA
Mixing and pellet forming area	2	6	
Residential area (100 m from factory)	0.2		0.3

These results show that upgrades undertaken at the factory were successful in maintaining dust concentrations both within the factory and in the residential area under the required standard.

Conclusion

The Cuu Long fertilizer factory has changed its manufacturing process three times over twenty years of operation to achieve optimum efficiency, improve production to meet the province's agricultural requirement for fertilizer plants, as well as to protect the environment. Upgrades made to the factory appear to have been successful in maximizing the socio-economic benefits of this industrial activity (e.g., jobs created, use of product in agriculture) while minimizing environmental impacts — both in terms of protecting the natural environment and the health of workers at the factory. Monitoring undertaken by DOSTE has demonstrated that the environmental impacts of the factory are minimal and that even these can be addressed through adoption of additional mitigation measures. The factory is

committed to working with DOSTE to continue to monitor the environment and to develop protection measures to meet the Vietnamese government's environmental standards.

SITE VISIT METHODOLOGY

Course participants will visit the Cuu Long fertilizer factory to observe conditions and learn more about the factory's environmental protection efforts. The visit will be an excellent opportunity for participants to observe how an older factory can adjust operations to meet existing Vietnamese operating standards despite not having been originally subject to an EIA. Participants will also learn more about Vietnam's new policy on environmental protection which requires older factories to assess the environmental impacts of their operations to determine whether they meet existing operating standards. During the one day site visit, the group will be accompanied by resource persons from DOSTE and the factory who are knowledgeable about all aspects of the factory and of environmental concerns.

Participants will be organized into small groups for the site visit with each group being assigned a specific task as follows.

SUBJECT	FOCUS
Air Quality Management	Baseline conditions Characterization of air emissions Air emissions inventory Impact assessment Mitigation measures Monitoring and measurement
Liquid and Solid Waste Management	Baseline conditions Characterization of waste streams Waste inventory Impact assessment Mitigation measures Monitoring and measurement
Noise	Baseline conditions Noise characterization Sound level inventory Impact assessment Mitigation measures Monitoring and measurement
Economic and Social Assessment	Economic changes as a result of the project (i.e., economic benefits at local and regional levels) Social changes as a result of the project (i.e., both positive and negative) Compensation and mitigation measures
Your own EIA for this factory	Your group has been asked to do the EIA for the factory. Describe how your EIA would be different from the existing EIA.

On completion of the site visit, small groups will be asked to present their findings to the class with emphasis on the practical lessons learned by participants which reinforce EIA theory taught in the course.

TAKE HOME MESSAGES

Anticipated lessons learned by course participants in completing the case study and site visit might include:

1. An appreciation of the difficulties in measuring environmental impacts of existing industries without having baseline information (i.e., documenting environmental conditions before the industry's presence) against which the magnitude of impacts can be assessed. This deficiency highlights the importance of completing comprehensive baseline monitoring as part EIA's completed for major projects and activities to ensure that before and after environmental quality can be clearly understood.
2. Reviews of EIA's which have been completed previously or completion of EIA audits on existing industries for which EIA's have not been done (e.g., the Cuu Long fertilizer factory) can provide valuable information to environmental managers concerning the actual environmental impacts of industry. Such feedback allows managers to assess whether existing environmental standards are sufficiently protective or whether they should be made more stringent.
3. EIA's should not be regarded as a single hurdle that industries have to clear in beginning operations but rather as part of a series of steps which are intended to provide ongoing environmental protection during the industry's entire life (i.e., from cradle to grave) – encompassing planning and design, construction, operation and decommissioning. Feedback provided from the initial EIA, regular environmental effects monitoring, and through internal environmental management systems (EMS), allows industries to continually assess the effectiveness of mitigation measures and to continually improve environmental performance though adopting current best management practices.

REFERENCE READING

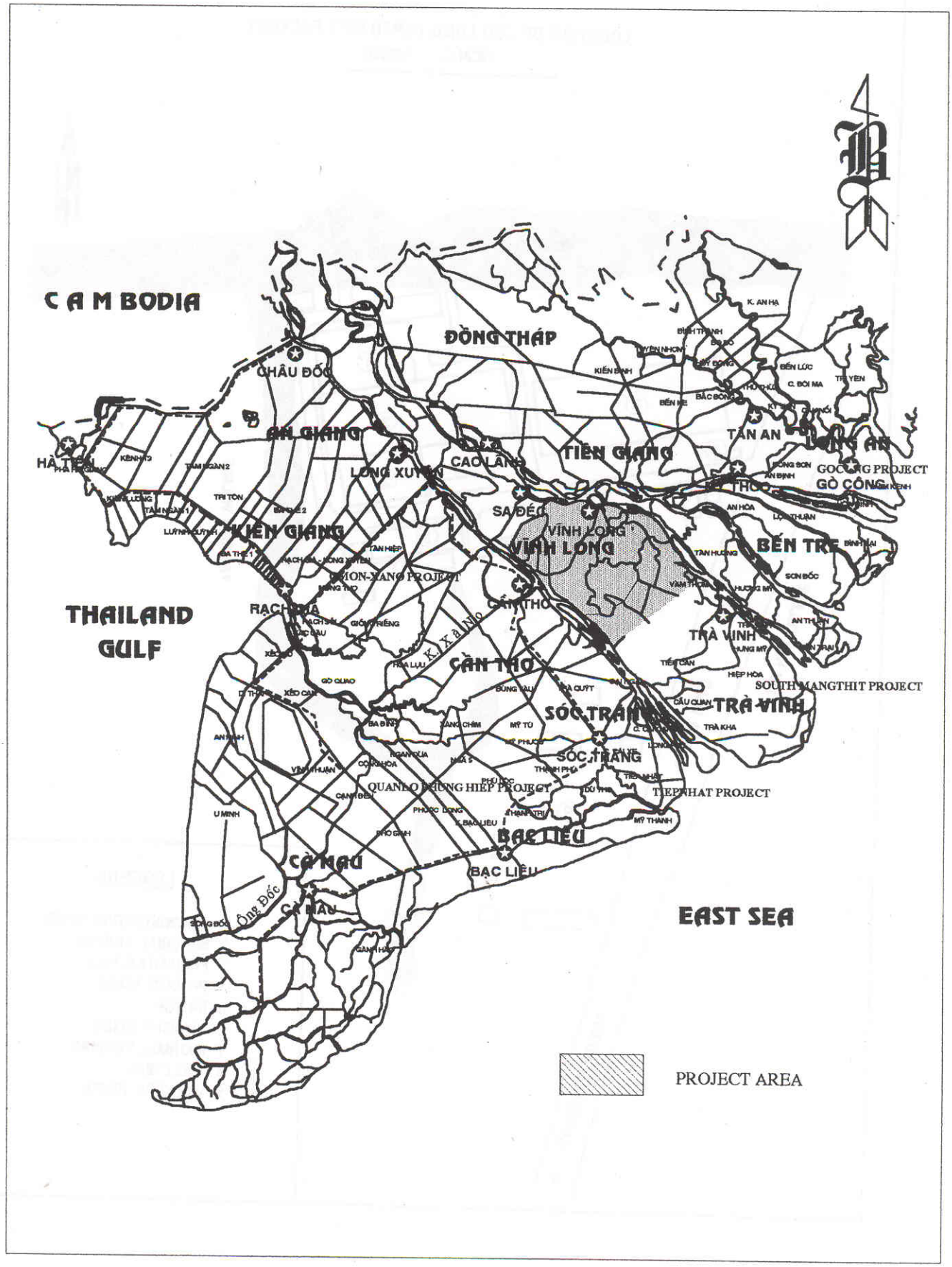
ADB. 1993. Fertilizer. Environmental Guidelines for Selected Industrial and Power Development Projects. Asian Development Bank. pp. 61-73.

Anonymous. 1996. Supplementary Report on Environmental Impact Assessment of Cuu Long Fertilizer Factory.

World Bank. 1998. Selections on Fertilizer Plants – Pollution Prevention and Abatement Handbook: Toward Cleaner Production. In Collaboration with the United Nations Environment Programme and the United Nations Industrial Development Organization. pp. 345-348, 353-358, 387-390.

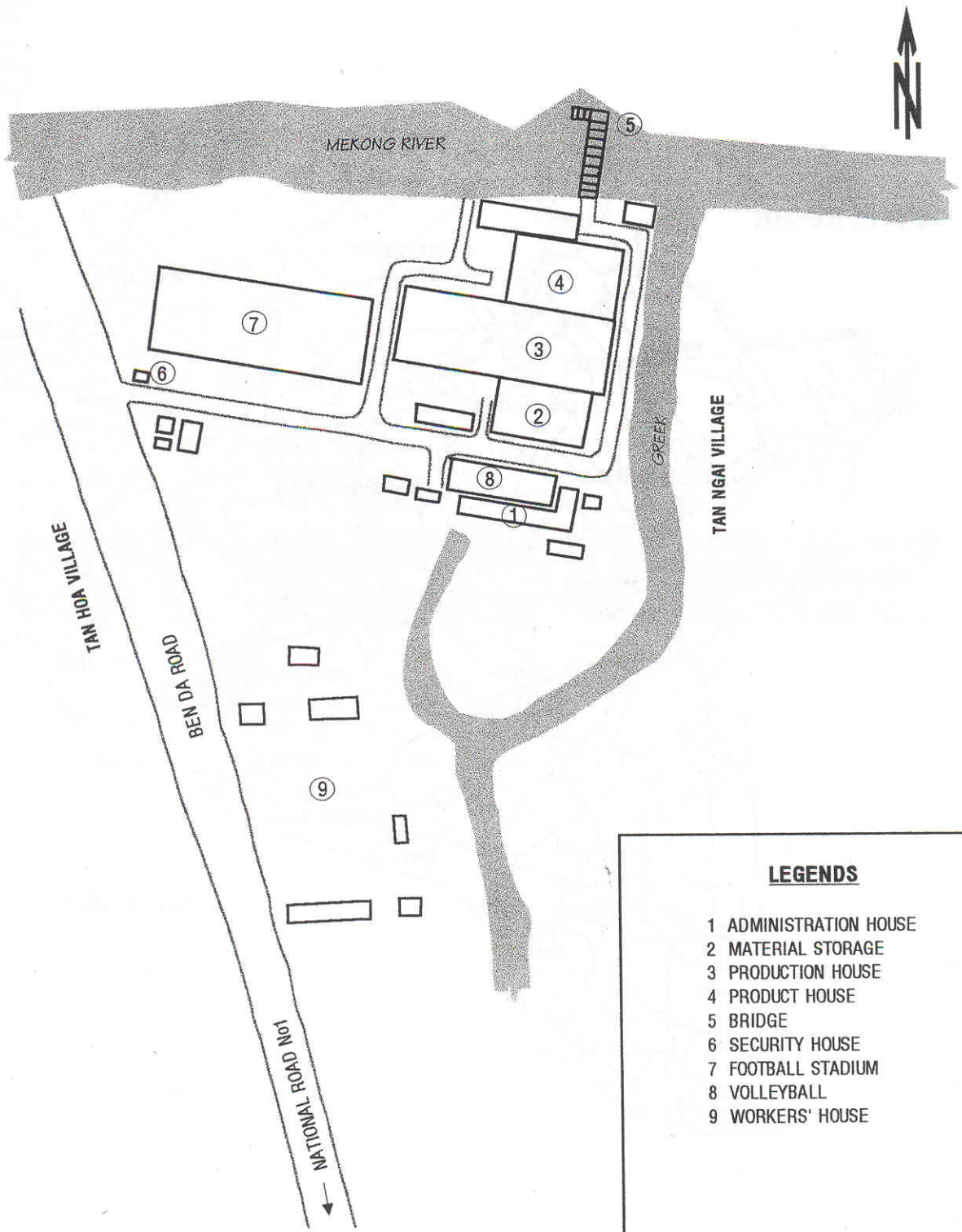
FIGURES

CASE STUDY IN VINH LONG IN THE MEKONG DELTA, SR. VIETNAM



LOCATION OF CUU LONG FERTILIZER FACTORY

SCALE: 1/2000



LEGENDS

1 ADMINISTRATION HOUSE
2 MATERIAL STORAGE
3 PRODUCTION HOUSE
4 PRODUCT HOUSE
5 BRIDGE
6 SECURITY HOUSE
7 FOOTBALL STADIUM
8 VOLLEYBALL
9 WORKERS' HOUSE

CHEMICAL COMPANY IN VIETNAM
SOUTHERN COMPANY OF FERTILIZER
CUU LONG FERTILIZER FACTORY
NO. 30/96

SOCIALIST REPUBLIC OF VIETNAM
INDEPENDENT – FREEDOM - HAPPINESS

Vinh Long August 6, 1996

SUPPLEMENTARY REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT OF CUU LONG FERTILIZER FACTORY

- Base on the decree 175/CP and instruction 34 CT - UBT of Vinh Long People's Committee.
- Base on the meeting's minutes of Environmental Impact Assessment Council at Department of Science, Technology and Environment of Vinh Long.

Cuu Long Fertilizer Factory would like to supplement to the report on environmental impact assessment with the following contents:

Project of Fire Protection of Cuu Long Fertilizer Factory

This measure has been approved by Office of Fire Preventing and Fighting of Vinh Long Police Office.

Project of Domestic Waste Treatment

In order to be possible for workers who work at the factory, to have a bath to ensure personal hygiene between the shifts, and to solve well the environmental problems, the factory has constructed a row of hygienic house consisting of 2 different toilets and 2 different bathrooms for men and women just behind the administration block. The toilets are septic with enameled tiles and spout to ensure hygienic standards. Next to them, there are 2 bathrooms with area of 4 m^2 each. They are also paved with enameled tiles. Behind this row of hygienic house, there are 6 shower - bathrooms for men. Those enable workers to wash and have a bath before going home.

Waste water Treatment Measurement

The domestic waste water here mainly is water from the kitchen, the toilets and the bathrooms. The quantity of waste water is about 9 m^3/day. Waste water is collected into a double cellar with the area of 2 m x 2 m x 2.5 m. The waste water is preliminary filtered by sand and gravel before flowing to drainage and irrigation ditches surrounding rice fields of the factory. The dimension of the ditch is 2.5 m wide, 2 m deep and 30 m long. The water hyacinth is grown in the ditch so that its root can absorb organic substances and microorganism to reclaim the waste water for irrigation.

Environmental Expenditure

The fertilizer factory will frequently coordinate with Department of Science, Technology & Environment of Vinh Long province to monitor the environmental parameters to promote measures for preventing harmful impacts to the environment. The measurement will be carried out twice a year:

- Dry season, about March
- Rainy season, about September

The environmental expenditure will be cost accounting into the price of the products of factory.

The factory will report to the Department of Science, Technology & Environment of Vinh Long province if there is a change of technology or equipment. The environmental protection measures will be mentioned to all processes of the factory to reach the government standards.

Deputy Director of the Factory
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