KAENG KHOI SIAM CEMENT PLANT
ENVIRONMENTAL MANAGEMENT SYSTEM

PURPOSE

ETP1 COURSE TOPIC COVERAGE:

- ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS)
- ISO 14001 GENERAL REQUIREMENTS
- ISO 14001 ENVIRONMENTAL POLICY
- ISO 14001 ENVIRONMENTAL ASPECTS
- ISO 14001 ENVIRONMENTAL MANAGEMENT PROGRAMS
- ISO 14001 MONITORING AND MEASUREMENT
- ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

This case study examines the importance of demonstrating to industry the benefits of environmental management systems (EMS) in convincing them to adopt such voluntary environmental protection measures. The experiences of a Thai industry that is already ISO 14001 certified are chronicled to understand: (i) why they decided to become certified; (ii) what benefits they have obtained as a result; (iii) what obstacles they faced in receiving accreditation; and (iv) what incentives they suggest that governments offer to encourage more industries to seek certification. Such insights are expected to be useful in promoting EMS to industries elsewhere in Thailand and in other Mekong River Basin (MRB) riparian countries. Since an EMS is an interdependent entity, each part relying on effective functioning of every other part of the system, the case study provides an opportunity to experience some 'hot spots' and critical decision points in an operating EMS.

ISSUES

Specific issues highlighted in this case study are:

1. Opportunities for industry to demonstrate good corporate citizenship and to gain competitive advantage as contributing factors in the voluntary adoption of EMS/ISO 14001
2. Potential government incentives to industry in developing countries to implement the ISO 14001 standard
3. The application of EMS by industry in minimizing potential environmental impacts through the systematic adoption of controls on manufacturing procedures ranging from raw materials, production, and products to waste management
4. The usefulness of EMS to industry as a means to integrate management and operational decisions that could cause environmental impacts into the overall process of managing their business

LEARNING OBJECTIVES

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

- Assess the Kaeng Khoi cement plant's Environmental Policy in relation to ISO 14001 specifications
- Identify the significant environmental aspects and impacts at the plant and quarries
- Develop their own environmental objectives and targets and environmental management programs for the major operations at the plant and quarries, and constructively critique the company's objectives and targets
- Comment, with examples, on the effectiveness of the organizational structure and key personnel roles and responsibilities in the EMS, with particular focus on the environmental management representative
- Assess the adequacy of resources to implement and maintain the EMS
- Identify training needs, and areas of awareness and competence which could be improved
- Identify who are the interested parties to Kaeng Khoi plant and quarrying operations, and draw up a list of questions for an interested parties survey
- Review and critique selected Standard Operating Procedures from the plant, including the Emergency Response Plan
- Identify potential environmental emergency situations at the plant and quarries
- Assess regulatory compliance performance at the Kaeng Khoi plant and quarries
- Develop a monitoring program for emissions to air and water, and for solid wastes, including sampling frequencies, locations, and variables to be measured
- Identify monitoring instruments which must be calibrated regularly
- List non-conformances at the plant and quarries, based on information received and observations made
- Comment on corrective and preventive actions taken by the plant to address non-conformances and, where necessary, prepare additional corrective and preventive action plans
- Draft a schedule of internal audits, including areas requiring priority attention
- Evaluate the effectiveness of the plant's Management Review process

PROJECT SUMMARY

Introduction and Background

Since its introduction in 1996, the ISO 14001 International Standard, which specifies requirements for environmental management systems, has been adopted by National Standards bodies in more than 130 countries. In Thailand, the Thai Industrial Standards Institute, Thailand Environment Institute, and the Thailand

Productivity Institute have been active in promoting the benefits of the Standard to business and industry. As of March 2001, almost 300 Thai organizations had achieved registration to the Standard.

ISO 14001 is viewed by many governments, businesses, and non government organizations (NGO) as one of the best hopes for attaining worldwide sustainable development and continual improvement in environmental management and environmental performance through self-regulation and self-monitoring. Because of its global reach, ISO 14001 is becoming a passport to international trade, as companies registered to the Standard can claim to have demonstrated to independent registrars that they have implemented basic management principles and practices which integrate environmental considerations into business decision-making and operational controls.

The Siam Cement Public Company Limited traces its origins to a Royal command by His Majesty King Rama VI (Vajiravudh) in 1913 as a means to make Thailand self-sufficient in cement for development purposes, and to maximize value from domestic natural resources. Kaeng Khoi Cement is Siam Cement's fourth plant, and the largest in Southeast Asia. It began operations in 1969 on 2,800 acres in Saraburi Province. The location was selected because of nearby sources of limestone and shale needed as raw materials in cement manufacture. Current annual production capacity is 7.3 million tonnes. The plant has achieved

SIAM CEMENT ENVIRONMENTAL POLICY

Siam Cement Public Company Limited produces Portland cement with pollution prevention and continual environmental improvement policy.

The company philosophy is 'To develop environmental quality of our factory to meet government environmental standards'.

Our environmental management concept is to control and reduce pollution effect e.g. from dust, noise, wastewater and solid wastes due to manufacturing process, transportation, raw materials and products etc. The procedures are as follows:

1. Control quantity of dust in the work place and surrounding community to meet air quality standards.
2. Re-circulate used water from manufacturing process and treat wastewater before discharge.
3. Improve the ambient environment (e.g. noise) of the work place.
4. Reuse of solid wastes.
5. Rigorously control consumption (e.g. fuel and electricity).
6. Strongly follow the Government's rules and regulations with respect to the environment.
7. Cooperate with both public and private agencies in order to promote environmental conservation.

Siam environmental policy has been documented and carried out by all staff of Kaeng Khoi Cement Industry in order to achieve the objectives. The policy can be publicized.

certification to ISO 9002 Quality Systems, and was registered to ISO 14001 EMS in April 1999.

Overview of Kaeng Khoi's Cement Manufacturing Operations

Plant Location

The Kaeng Khoi plant is located on flat land approximately 26 m above sea level in Tambon Ban Pa, Amphhoe Kaeng Khoi, Saraburi province, about 127 km northeast of Bangkok. On the north and east sides of the property are limestone ridges, which supply one of the primary raw materials to the plant. The Pa Sak River is about 2 km west of the site.

Mining of Raw Materials

Limestone and shale are quarried using techniques designed to minimize environmental impacts. According to company information, the surrounding forest is maintained in its original condition (which also helps to reduce dust dispersion), and excavated areas are back-filled and reforested.

Cement Manufacturing Process at the Kaeng Khoi Plant

Primary raw materials for cement manufacture (limestone and shale) are transported from nearby quarries to the site, where they are processed through primary and secondary crushers to a particle size of 25 mm, mixed in a 3:1 ratio, and stored as 'raw meal' in a homogenizing silo. Raw material proportions in this process are computer-controlled using X-ray spectrometry. Oversize material is separated and returned to the crushers for re-processing. Other, minor raw materials used are clay and laterite.

The raw meal is conveyed to four pre-heater rotary kilns equipped with pre-calciners, and fired at 1,450ºC with gas, oil, or combinations of these fuels. Coal or lignite may also be used as fuel. The dark gray product from the calcining process, called clinker, is air-cooled to less than 100ºC above ambient. Heat recovered from this process is re-used in the kiln and elsewhere in the plant.

Clinker is conveyed by inclined bucket chains to storage silos or truck loading hoppers, from which it is ground in a closed-circuit system, and combined with 4-5% gypsum (calcium sulphate) to produce Portland Cement. Automated bag packers process 4,000 bags per hour (200 tonnes of cement), which are loaded onto trucks or trains for transport to customers. Finished product is transported from the plant in bulk shipments by road or rail, or in 50 kg kraft paper bags, which are manufactured on-site.

Human Resources Development and Community Development

In addition to the actual production process at the plant, the Kaeng Khoi management has a strong commitment to human resources as part of their Total Quality Commitment (TQC) at the plant.

Plant management recognize that the most important factors in manufacturing high quality cement and maintaining high productivity are employee training and health. To this end, training and other health activities have been implemented to continuously develop the skills and knowledge of the plant's employees, and to maintain a high quality of life for employees and their families. The plant's TQC program includes employee participation in workshops on safety, quality, the plant good house-keeping. Employee benefits include on-premise health care and medical facilities staffed by qualified physicians. The plant also provides sports and recreational facilities for employees and family members.

Additional quality of life programs supported by the plant to extend benefits to employees and their families are:

- Cooperatives managed by employees and their families
- Kaeng Khoi Housewife Club established to encourage families to participate in projects such as professional training for housewives
- Food project to provide fresh and insecticide-free vegetables to employee's families
- Sports training programs, scholarship programs, youth camps and computer camps for children of employees

Kaeng Khoi plant management's commitment to playing a constructive role in the local community reflects the corporate principle of 'Concern for Social Responsibility'. Community programs include sponsoring scholarships for youth, funding student lunches, providing educational materials and sports equipment, and supporting various religious activities. Furthermore, plant management supports vocational training programs in agriculture, provides basic infrastructures, and funds projects valuable to the community. Health care services are also provided to the community by a mobile medical unit which provides free services to villagers.

Pollution Controls at the Plant

Air Emissions

Stack emissions from the kiln pass through electrostatic precipitators (ESP) designed to remove particulates. For optimum operation, ESP require some moisture in the gas stream, but at the high temperature of the calcining process, all moisture has evaporated. As a consequence, problems may occur with ESP efficiency. An effective preventive maintenance program implemented by trained, qualified personnel is essential for continual high-performance of the ESP. Other dust generating operations in the plant are fitted with bag filters. Clinker is used to absorb sulphur dioxide emissions.

Effluent Discharges

An oil trap has been installed to collect fuel oil leaks from the kiln, which become mixed with the cooling water discharge. However, the trap does not always operate effectively.

Solid Wastes

Miscellaneous solid wastes are removed from the plant site for disposal by contractors.

Environmental Impacts

Air

Sulphur dioxide and nitrogen oxides are potential air contaminants that could have environmental impacts. Based on monitoring information, the area around Khao Pun, approximately 2 km north of the plant, which is uninhabited, is subject to SO_2 and NO_x levels above ambient standards.

Excess particulate emissions to the external environment occur if the electrostatic precipitators are not operating effectively. Based on air dispersion modelling, the village of Tambon Tha Khlo is the area most affected by dust emissions from the plant.

In-plant levels of dust exceed permissible workplace levels in the crushing, grinding, and conveying areas. Workers are required to wear protective dust masks in these areas.

Fugitive dust from lignite storage, transportation, crushing, and grinding is another source of emissions to the atmosphere. There is also a risk of spontaneous combustion of lignite storage piles.

Noise emissions exceed allowable levels in certain areas of the plant and at the quarries, where limestone and shale are mined. Ear protection is mandatory in these areas. According to the company, there have been no complaints from residents in the village of Ban Pa (approximately 2 km south of the quarry) about vibrations from blasting, or property damage from flying rock debris. Residents of the village are employed by the plant.

A planned increase in plant capacity will require an approximate doubling of raw materials mined from the quarries (to more than 12,000 tonnes per day). This expansion will probably result in increases in dust and noise from blasting and mining activities, vehicle traffic, and increased cement production. Aesthetic degradation in the form of quarry scars, emission plumes, and other visual effects are also expected. The villages of Tambon Tha Khlo, Tambon Ban Pa, and Ban Tao Pun are the most likely to be affected by the new developments.

Effluent Discharge

Oil and grease, raw materials, and cement products may contaminate cooling water discharged from the plant, causing environmental impacts in receiving waters. Water discharged from the canteen, office, and staff house may also contain oil and grease. Contamination of groundwater and surface water may occur by leachate from the coal or lignite ash dumping site.

Solid Waste Disposal

Spills may occur during loading, unloading, and handling of lignite or coal, which can result in contamination of land and/or water. No other information was made available on the types and amounts of process or non-process solid wastes, or storage, handling, and disposal practices for them.

SITE VISIT METHODOLOGY

A two day site visit is planned to the Kaeng Khoi plant to review the company's strategies and procedures in the planning, implementation, and maintenance of their ISO 14001 EMS. The visit will not be an audit for two main reasons: (i) the ISO 14001 EMS course does not include the skills and practices of environmental auditing; and (ii) permission has not been requested from Siam Cement to conduct an EMS audit. Therefore, participants should not attempt to audit the facility during the visit. Discussion of observations, document review, and meetings with site management and operating personnel will take place off-site on the evening of the first day of the visit, and on our return to the classroom following the visit.

Each participant will be assigned to a small group with each group being allocated specific areas of the EMS, on which they will be expected to acquire information and draw conclusions before, during, and after the site visit. Group areas of responsibility are summarized in the following table.

SUBJECT	FOCUS
Quarrying operations, and air emissions at the quarries and from the plant	Environmental aspects and impacts Objectives and targets Environmental management programs Roles and responsibilities of managers and workers Training, awareness, and competence Communication with external interested parties Operational controls Emergency preparedness and response Monitoring and measurement Corrective and preventive actions
Transportation of raw materials, and raw material preparation	Environmental aspects and impacts Objectives and targets Environmental management programs Communication with external interested parties Operational controls Emergency preparedness and response Corrective and preventive actions
Pre-calciner, kilns, clinker processing	Environmental aspects and impacts Objectives and targets Environmental management programs Structure and responsibilities of managers and workers Training, awareness, and competence Operational controls Emergency preparedness and response Monitoring and measurement Non-conformance Corrective and preventive actions
Product mixing, storage, packaging, and shipping, fuel storage	Environmental aspects and impacts Objectives and targets Environmental management programs Training, awareness, and competence Operational controls Monitoring and measurement Corrective and preventive actions
Environment department, EMS administration	Development of Environmental Policy Organizational structure and responsibilities for all operations Training programs needs assessment and evaluation Internal and external communications Document control procedures Operational control Emergency preparedness and response Monitoring and measurement for air, effluent, and solid wastes Regulatory compliance monitoring and performance Non-conformance – roles and responsibilities, procedures EMS record keeping Internal environmental audits Management review Costs and benefits, and incentives for implementing an EMS

On completion of the site visit, small groups will be asked to present their findings to the class with emphasis on practical lessons learned by participants which reinforce EMS theory and ISO 14001 practices taught in the course.

TAKE HOME MESSAGES

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

1. Key benefits to industry of voluntarily adopting EMS and achieving accreditation under the ISO 140001 standard include: (i) competitive advantage in selling their product in national and international markets; (ii) increased recognition and stature in their communities as good corporate citizens; and (iii) reducing the potential for costly shut-downs or mandatory adoption of expensive mitigation measures (i.e., as required by government regulators in response to exceedences of environmental standards) by proactively addressing environmental concerns.
2. Full commitment by industry managers to environmental protection is fundamental to the successful implementation of EMS. Unless managers are committed to adopting good operating practices and seeking continued improvement in achieving environmental objectives and targets then the long-term benefits of adopting an EMS in terms of improved environmental quality in a country may not be attained.
3. Training is critical to successful EMS implementation. Comprehensive training of staff in both skills (e.g., good operating practices) and awareness-building is a necessary aspect of an organization's EMS. For EMS to work, everybody in an organization needs to understand the importance of their day-to-day actions in potentially causing environmental impacts and must have the necessary knowledge and skills to avoid or minimize such impacts.
4. Prevention (rather than correction) is the philosophy of choice with regard to environmental management.

REFERENCE READING

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ISO 14001. 1996. Environmental Management Systems - Specification with Guidance for Use. International Organization for Standardization, Geneva.

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Assorted Appendices.