

Hazardous Waste Management in Thailand*

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INTRODUCTION

Thailand's high economic growth since the late 1980s has mostly been due to the country's rapid industrialization. The main target of industrial output has changed from domestic consumption to export. While an industry-driven economy creates higher income opportunities for some people, it also has an undeniable impact on the country's environment and on its natural resources. Industrialization has introduced to Thailand, as it has elsewhere, the use of hazardous substances as raw materials and the production of hazardous wastes. The hazardous waste problem in Thailand has dramatically worsened in recent years. Thailand is now a country with a high hazardous waste potential.¹

This paper summarizes the state of affairs regarding hazardous waste in Thailand. It purports to assess the potential health and environmental impacts of hazardous waste in Thailand, to describe what has been done in terms of control and management, and to suggest what needs to be done to accomplish the goals of sustainable development.

PRODUCTION OF HAZARDOUS WASTE IN THAILAND

A United Nations study² found that transnational corporations from industrialized countries moving to developing countries often did not take into serious consideration the host country's environmental regulations. The exception to this was the production of certain heavy metals, asbestos, benzidine dyes, and pesticides. This may help explain why Thailand increased the importation of asbestos from 50,690 tons in 1978 to 128,126 tons in 1992 (see [Table 1](#)). Asbestos now ranks as number one of all hazardous substances imported into Thailand. A study commissioned by the Office of the National Environment Board in 1986 to formulate a hazardous waste management plan for Thailand³ estimates that heavy metal sludge and solids form the largest quantity of hazardous waste generated by Thai industries (see [Table 2](#)). Of the total 1,160,780 tons of hazardous waste generated in 1986, heavy metal sludge and solids accounted for 832,870 tons, or 71.75 percent.

Since this study used the United States' waste generation rate for its estimates, the Department of Pollution Control (DPC) of the Ministry of Science, Technology and Environment requested the Department of Industrial Works of the Ministry of Industry to revise the national inventory. The revised quantities turned out to be lower than the earlier study (see [Table 3](#)); the total amount of waste generated in 1986, for example, dropped from 1,160,780 tons to 531,154 tons. Even after the revision, however, heavy metal sludge and solids still top the list, although their proportion has reduced from 71.75 percent to 56.92 percent. The revision estimated that by the year 2001, Thailand will produce 2.8 million tons of hazardous waste per year.

Currently available data shows that a significant amount of hazardous waste has been imported into Thailand in various forms (e.g., raw materials). Such waste comes not only from developed countries but also from developing countries. Additionally, there is a good deal of illegal dumping of hazardous waste from other countries at Bangkok's Klong Toey Port. In 1989, Engineering Science *et al.* estimated that the

quantity of hazardous waste stored at the Port was 161,937 kg; it recommended measures which would cost about .27 million baht to properly dispose of the waste. No action was taken; and in 1991 a major explosion at the port killed 10 people and caused substantial acute and chronic health problems to thousands of people in the vicinity, claiming even more lives later.

In April 1994, the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal banned all shipment of hazardous waste across national boundaries. Thailand is a signatory but does not ratify this agreement. Ratification would be an important step in controlling hazardous waste dumping by foreign sources.

POTENTIAL IMPACT OF HAZARDOUS WASTE ON PUBLIC HEALTH AND THE ENVIRONMENT

Health Indicators

A 1990 study co-sponsored by the United States Agency for International Development (USAID) and the United States Environmental Protection Agency (USEPA) identified three categories of environmental health risks in Bangkok:

- The high risk category includes: 1) particulate matter, 2) lead and 3) microbiological diseases;
- The medium risk category includes: 1) carbon monoxide and 2) other metals;
- The low risk category includes: 1) toxic air pollution, 2) other air pollutants (SO₂, NO_x, and O₃), 3) surface water contamination, 4) ground water contamination, 5) food contamination and 6) solid and hazardous waste disposal.

The report estimated that particulate matter might have led to a loss of 9-51 million work days per year for Bangkok residents, because of restricted activity due to respiratory problems, and up to 1400 deaths per year.

The report found that lead might have caused several hundred thousand cases of hypertension, up to 400 adult male deaths and the loss of IQ points for 700,000 children up to the age of seven for each cohort.

The report further indicated that microbiological diseases might have caused 0.85-1.7 million cases of illness, which accounted for 6 percent of the deaths attributable to microbiological diseases. It identified 28 of these diseases as "environmentally-related."

To complement this study, health statistics have been compiled for the central region's 24 provinces, with a focus on three provinces in the Eastern Seaboard Region: Chonburi, Rayong and Chacheongsao. The most significant of these statistics are:

- Deaths due to cancer are rapidly rising in Thailand. The incidence of death due to malignant neoplasm in Thailand has been steadily increasing, from 9.06 per 100,000 population in 1962 to 40.96 in 1991 (see [Figure 1](#)). Although the causes of malignant neoplasm are still not fully understood, environmental pollution cannot be ruled out;
- The incidence of disease (defined as the number of patients per 100,000 resident population) was calculated for 24 provinces in the central region. Preliminary findings show that for the period 1989 to 1991 both the average incidence of malignant neoplasm and the rate of perinatal morbidity and mortality were significantly higher in the three provinces in the Eastern Seaboard Region than the average for the remaining 21 provinces (see [Table 4](#)).

The Environment

Downstream from Bangkok, the Chao Phraya River has been contaminated with heavy metals from industrial discharges.⁴ In the Gulf of Thailand, just below the mouth of the Chao Phraya, for example, the dissolved mercury content ranges from 0.7 to 4.0 ppb (parts per billion). Concentrations of mercury in non-polluted water are less than 0.1 ppb. (The limit for mercury in drinking water is 2 ppb.) There was also a

bio-magnification of mercury in the food chains, as evident from the samples of shell-fish, fish, and fish-eating birds collected along the river and in the Gulf of Thailand.

Like most rivers in Thailand, the Chao Phraya has been progressively contaminated by heavy metals, especially lead. A study in 1989 showed that 18 major rivers in Thailand were contaminated with heavy metals. A subsequent study in 1991 found that 25 of the total 43 rivers in Thailand were contaminated.⁵

Leachates and spills from mining and smelting operations also pose a heavy metal contamination problem. In 1985, for example, cadmium, lead and manganese were reported in "alarming concentrations" in the upper reaches of the Chao Phraya, the high levels having been caused by an accidental spill from a zinc smelter. In 1987, more than 1,200 villagers from the Rhon Pibul district in Nakhon Si Thammarat province were reported to have suffered symptoms of poisoning by arsenic leaching from piles of tin mining tailings and ore dressing that contaminated their water wells.⁶ This problem continues to today.

Hazardous wastes are known to be potentially carcinogenic. Arsenic tops the list of hazardous wastes listed by WHO,⁷ and is of particular concern to the environmental regulatory institutions of industrialized nations. Arsenic poisoning is readily visible. By contrast, heavy metal poisoning, often a health hazard of chronic or long-term nature, is very difficult to identify. A study conducted in 1977 showed that fish, shrimp and shell-fish living in contaminated reservoirs had concentrations of lead as high as 16.5 to 33.6 ppm (wet weight), which could be harmful to consumers.⁸

PRESENT STATUS OF HAZARDOUS WASTE MANAGEMENT IN THAILAND

Definition

There still is no formal definition of "hazardous waste" in Thailand. The implications of this are numerous, not the least of which are the difficulties encountered in the planning, design, and implementation of study projects, and the maintenance of an appropriate system to inventory these wastes, their sources and treatment methods. If Thailand is going to ratify the Basel Convention, there is a need to first legally define the term "hazardous waste."

The Environmental Quality Standards Division, Office of the National Environment Board, used to provide a definition of hazardous wastes as "substances or materials which are not used or cannot be used, which contain or are contaminated with combustible substances, corrosive substances, highly active substances, explosives, toxic substances, soluble substances, radio-active substances, and/or disease producing organisms which are produced by various industrial, community, agricultural activities."⁹ This definition follows the United States concept, and has wider applicability than the Basel Convention's definition. The Basel Convention does not include radioactive substances, as it is considered that there are separate laws concerning this matter.

Due consideration must be given to adopting or adapting the above definition so that research on and prevention of hazardous waste contamination may be effectively carried out.

Legislative and Institutional Base

Thailand does not have an integrated legislative structure for the control and management of hazardous waste.

Legislation is fragmented and the jurisdiction and authority to implement these laws is spread out in several ministries, viz., the Ministry of Industry, the Ministry of Science, Technology and Environment (MOSTE), the Ministry of Public Health, and the Ministry of Agriculture and Cooperatives.

The major laws involving hazardous waste management are:

- Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (1992);
- Factory Act B.E. 2535;
- Hazardous Substance Act B.E. 2535;
- Factory Act B.E. 2535;
- Public Health Act B.E. 2535.

The authority directly concerned with industrial hazardous waste is the Hazardous Waste Disposal Subdivision of the Office of Industrial Services and Waste Management in the Ministry of Industry. Despite the country's rapid industrial growth, this subdivision has not been allocated more manpower to deal with escalating hazardous waste problems. Moreover, the Hazardous Waste Management Action Plan 1992 was made inactive following the reorganization of the Office of the National Environment Board—the government agency directly responsible for the country's environmental problems. This inactive status has dashed hopes for a systematic approach to hazardous waste management in Thailand.

Concerning pollution control, the Ministry of Industry has issued several ministerial regulations, as follows:

- The Ministry Announcement No. 25 (1988), which decrees that all factories have to carry out proper treatment of polluting and discarded materials;
- The Ministry of Industry Announcement No. 57 (1990), which stipulates that all waste materials specified in the Basel Convention are toxic wastes that have to be under the control of the laws;
- The Ministry of Industry Regulation No. 2 (1992), which stipulates the control of all wastes, pollutants or any other materials which are hazardous to the environment.

Management Approach

Hazardous waste management problems in Thailand are not due to a lack of responsible agencies. Rather they are caused by a lack of coordination among all the agencies concerned, insufficient personnel and budget allocation in these agencies, an absence of integrated regulatory enforcement structure, and a lack of political will to tackle the problem.

The lack of an integrated approach to the regulation and control of industrial hazardous waste results in overlapping, and sometimes duplication, of the legal authority and responsibility of government agencies. A first step, however, has been taken. The Sub-Committee on the Environment and Industrial Management Coordination has been created between the Ministry of Industry and MOSTE. Furthermore, there are other agencies, such as the Customs Department, the Port Authority of Thailand and the Office of Atomic Energy for Peace, which have a role in hazardous waste control.

Law Enforcement

The law states that waste generators in Thailand have to report to the authorities the quantities and characteristics of the hazardous wastes they generate. The private sector must be assisted in making these required reports. At the same time, authorized personnel must be properly trained to review the submitted reports. Their skills need to be developed for law enforcement in Thailand to have any meaning.

There is also a need to provide appropriate measures to eliminate the promotion or establishment of industries which produce hazardous wastes—in other words, to stop the increase of dirty technology in Thailand. Already existing hazardous wastes should be strictly controlled with an aim to eventually rid the country of them. Clean technology should be promoted in order to reduce pollution. These are the responsibilities of all government agencies and private industrialists who care for sustainable development. Their efforts should take into account the health, safety and concerns of the people they serve. Likewise the public should be educated about the dangers of hazardous wastes and the urgent need for environmental conservation; this will hopefully create a true partnership in law enforcement and effective pollution control.

Existing Treatment Center

In 1983, the Canadian International Development Agency (CIDA) funded a pre-feasibility study for the construction of a plant for the treatment of industrial hazardous waste in Bangkok and its vicinity. The estimated annual volume of waste from 682 factories out of 862 possible waste generators is shown in [Table 5](#). It can be seen that the electroplating industry and the textile industry are the biggest polluters, generating, respectively, about 84,000 tons of waste water and 38,300 tons of sludge each year.

In 1986, the Asian Development Bank sponsored a pre-feasibility study of a combined industrial wastewater and hazardous waste treatment facility in Samut Prakarn province, which has the largest number of industrial establishments in Thailand. As the estimates of hazardous waste generated by various industrial sectors show (see [Table 6](#)), a good deal of hazardous waste in Samut Prakarn is generated by the tanning and chemical industries. Despite these studies and the apparent great need for a treatment facility, none has been built to date.

On the basis of these pre-feasibility studies and the aforementioned estimates for hazardous waste inventories, the Division of Industry Work (DIW) built in 1988 a pilot-scale industrial hazardous waste treatment center at Samae Dam, Bang Khun Tian district, in a western suburb of Bangkok.¹⁰ The center comprises: (a) a chemical treatment plant for treating electroplating waste-water on a batch basis, with a capacity of 200-cmd (cubic metres per day); (b) an 800-cmd-capacity continuous chemical treatment plant for textile dyeing wastewater; and (c) a 100-ton solidification facility for hazardous sludge or solid waste. The government has spent 31.5 million baht on the center and has leased it out to a private company to operate. The 80 hectare disposal landfill site is in Ratchaburi province, about 100 km southwest of Bangkok.

The Samae Dam center's capacity is, however, insufficient for the whole country. As of 1992-1993, the amount of waste treated by the plant represents approximately 10 percent of the estimated 0.9 million tons of waste generated each year. Therefore, the DIW plans to have four more hazardous waste treatment centers at Chonburi, Rayong, Ratchaburi and Saraburi to serve the industries in and around Bangkok. The Ratchaburi center will be the extension of the Samae Dam center, and will have an incinerator of 15,000 tons/year capacity, with a secure landfill of 10,000 tons/year. The government has provided the budget for land acquisition and development to do this. The Chonburi center will have a capacity of 70,000 tons/year for the physico-chemical treatment of heavy metals, 15,000 tons/year for incineration, 100,000 tons/year for solidification treatment and 7,200 tons/year for distillation treatment. The Saraburi center will process 70,000 tons/year in physico-chemical treatment, 15,000 tons/year for incineration and 100,000 tons/year for secure landfill. The Rayong center will process 100,000 tons/year for secure landfill. The construction of the Chonburi and Rayong centers has been delayed because of opposition from local communities.

As of February 8, 1994, DIW had a memorandum of understanding with GCN Holding Co. Ltd. for the latter to be a private partner in the development of the hazardous waste treatment centers. GCN holds 75 percent while the Government holds 25 percent of the primary registered capital of 600 million baht. The capital investment for the project is about 2,370 million baht. The centers are expected to be ready for operation in 1995.

Another private company, Bechtel International Inc., plans to develop a hazardous waste treatment plant in the Eastern Seaboard area to focus primarily on hazardous waste generated by the petroleum and petrochemical industries. The Bechtel plan is the outcome of the company's commercial feasibility study that was commissioned by the Industrial Environmental Management (IEM) Program of the Federation of Thai Industries (FTI). The company plans to receive waste for treatment as early as the second half of 1995.

Technical Capacity

The complexity of hazardous waste problems demands a multidisciplinary approach to its control, calling for expertise in science, engineering, public health, medicine, and economics. Expertise in many of these fields is limited in Thailand, as in other developing countries.

Acknowledging this problem, the Institute of Environmental Research at Chulalongkorn University has proposed to establish a graduate program in Hazardous Waste Disposal Technology and Management in some selected universities. Hazardous waste-related courses have been taught in Thailand only since 1991; at present they are offered at the graduate level at the Asian Institute of Technology, Chulalongkorn University and King Mongkut Institute of Technology - Thonburi.

WHAT NEEDS TO BE DONE

If Thailand is to achieve the goal of sustainable development as outlined in the Seventh National Economic and Social Development Plan (1992-1996), immediate action is urgently required.

More hazardous waste treatment facilities are needed. The "Polluter Pays Principle"—i.e., that companies causing environmental pollution should be made to pay for the damage they incur—should be strictly enforced in Thailand, as this has proved effective in many developed countries. Treatment facilities should meet international safety standards. The public should be informed of the benefits of such facilities so as to avoid the NIMBY (Not-In-My-Backyard) syndrome.

The Hazardous Waste Management Action Plan 1992 should be reactivated and should set appropriate schedules for action to promote industrial sustainability.

Human resource development for hazardous waste management should be a priority, both in the government and the private sectors.

The institutional and legal framework for the enforcement of hazardous waste laws needs to be strengthened. An integrated approach to environmental enforcement is more practical and cost-effective in the long term. Until this happens, at least a ministry-wide *consistency* should be a minimal requirement in the procedures and regulations which implement hazardous waste laws.

Thailand should set a goal for pollution prevention or clean technology. Being a latecomer in the arena of industrialization, Thailand has a better chance to accommodate the latest technology in hazardous waste control. The "Pollution Prevention Pays Principle" can be used as a basis for promoting industrial incentive to minimize the use of hazardous substances as raw materials.

Since hazardous waste is a problem of international concern, it would be beneficial for Thailand to ratify and become a member of the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal. This will help Thailand to tackle the problem of illegal dumping of hazardous waste.

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