THAILAND'S ENVIRONMENTAL ENFORCEMENT PROGRAM

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SUMMARY

Specific enforcement in the area of industrial estate is mentioned. Some integrated strategies of service and enforcement have been applied. Service fee can include penalty cost. Finally, third party (no power) inspection is applied together with efficiently service.

1 ENVIRONMENTAL MANAGEMENT OF INDUSTRIAL ESTATE IN THAILAND

1.1 Background

The Industrial Estate Authority of Thailand (IEAT) was established in 1972, to support the systematic and orderly development of industries.

Thailand has seen a vast explosion of industrial production over the past few years. Strong governmental support has increased the progress of such development and has made possible some outstanding feats of organizational and logistic achievement.

However amongst the success of increased production and the subsequent economic benefits that have been accrued it must be remembered that the costs of production are not only economic but also social and environmental.

1.2 Roles and activities

In 1972 in order to install some kind of brake and control on this problem it was decided to set up the Industrial Estate Authority of Thailand.

The authority is in place for a number of reasons, primarily it functions to ensure that a cohesive industrial development planning and zoning system can be maintained.

The authority is also concerned with the orchestration and evolution of environmental management involved with new industry within the estates. At present there are 23 estates throughout Thailand and will raise up to 54 in the year 2001.

Further, the authority is at liberty to ease problems caused by a malfunctioning infrastructure by installing a central wastewater treatment system, solid waste treatment and disposal facilities, water supply system, electricity distribution line system, telephone and road network within all of the industrial estates

In addition to these tasks the authority is also in a good situation to select the most suitable location where less environmental impact to communities. Industrial estates are in fact self-contained communities complete with their own infrastructure commercial banks, shopping centers and residential area.

The Pollution Control Department has authority to monitor environmental quality, for example, quality of rivers, sea water, ambient air, etc. in industrial estates and surroundings. The monitoring report will be sent forward to Industrial Estate Authority of Thailand as information for pollution control strategies.

1.3 Enforcement policy

The authority is a semipublic government agency existing under the Ministry of Industry. The agency is chartered to carry out the government's industrial development policy in harmony with the environment. The Industrial Estate Authority of Thailand seeks to maintain the highest standards at its industrial estates. For this reason, the authority sets very strict regulations over industries located within the boundary of each estates. According to national strategy documents and ministerial speeches, the Thai government has based its environmental policy on the "Polluter-Pays-Principle". The Industrial Estate Authority of Thailand had experience in the application of the Polluter Pays Principle through a system of pollution charges to industries which make use of common waste treatment facilities for many years. The charge formula employed in industrial estates builds from investment cost, operate and maintenance cost, variable cost (depends on the biological oxygen demand -BOD loading) and penalty costs. Extra charges or penalty costs are imposed for industries contributing wastewater exceeding influent standard to the central wastewater treatment facility.

2 CENTRAL POLLUTION CONTROL FACILITIES PROVISION

2.1 Design criteria for control facilities preparation

2.1.1 Solid waste generation

a) Industrial zone	18 kg/rai*/day
b) Residential and commercial zone	0.8 kg/rai*day

2.1.2 Hazardous generation estimate 5 % of total solid waste

2.1.3 Water use

a) Industrial zone	7-9 m^3/rai*/day
b) Residential zone	8-50^3/rai*/day according to type of building
c) Office and commercial zone	20 m^3/rai*/day

* Note: 1 acre = 2.5 rai

2.1.4 Wastewater discharge

Amount of wastewater estimated 80% of water consumption plus 10% of infiltration into collection system.

2.2 Operation and maintenance

The Industrial Estate Authority of Thailand dispatches managers and their staff to operate and maintain facilities in good condition as well as to integrate permits and inspect industries. Since 1994 Industrial Estate Authority of Thailand has allocated only the job of operation and maintenance to private professional contractors.

3 ENFORCEMENT IMPLEMENTATION

3.1 Wastewater pretreatment

Pretreatment process on-site of each industry will be required before discharging to the central unit if quality of influent is beyond acceptable limit of design. This process must be approved before issuing a permit license. The acceptable parameters are shown in Table 1. The expected effluent quality will meet the standards, set forth by government authorities as in Table 2 and must be monitored by other government agencies.

3.2 Air pollution

Major source of air pollution comes from exhaust gas of incinerators and stacks. Thereby all factories must conform both the air emission standards as shown in Table 3 and maximum allowable emission rate at different height of stack recommended by the EIA report of the specific estate location. Some examples are shown in Table 4.

3.3 Solid waste disposal

3.3.1 General waste

Industrial Estate Authority of Thailand provides either incinerator or sanitary landfill as a central unit for each estate both for industrial zone and residential commercial zone.

3.3.2 Hazardous waste

Since there is no final disposal for hazardous waste in Thailand, all industries must store their own waste at place and report to Industrial Estate Authority of Thailand when need to transport to other places. For new estate, Industrial Estate Authority of Thailand provides central hazardous wastestorage house up to 3,000 square meter to collect waste at least 5 years.

4 CONCLUSION

In supplementary of enforcement, Industrial Estate Authority of Thailand promote high standards performance in industry by giving annual awards under the title “Best Factories Awards”. A competition which allows the best factory to be acknowledge for their high standards of workmanship, organization and working condition will regularly highlight under criteria, covering all aspect of operations. Efficiency in organizational management, efficiency production process, environment and energy conservation, safety and bio-sanitation, and social responsibilities are concerned topics for judging. Industrial Estate Authority of Thailand do hope that strategies mentioned above will create an effective compliance and enforcement action and also appreciate for recommendation to motivate compliance behavior.

Table 1. Acceptable Characteristics for Central Wastewater Treatment, Process

1. Average BOD5	=	500	mg/l
2. Average Suspended Solids	=	200	mg/l
3. pH	=	5.0 - 9.0	
4. Temperature	=	45	°C
5. Sulfide as hydrogen sulfide	=	5	mg/l
6. Cyanide as hydrogen cyanide	=	2	mg/l
7. Oil and Grease	=	10	mg/l
8. Tar	=	10	mg/l
9. Formaldehyde	=	2	mg/l
10. Phenol and Cresols	=	1	mg/l
11. Free Chlorine	=	5	mg/l
12. Insecticide	=		none
13. Radioactive compound	=		none
14. Fluoride (F)	=	5	mg/l
15. Free Ammonia	=	5	mg/l
16. Total ammonia Nitrogen as N	=	50	mg/l
17. Mercury and Mercury Compound	=	0.005	mg/l
18. Soluble Iron and Manganese	=	10	mg/l
19. Chromium, Arsenic, Silver, Selenium, Lead, Nickel, Barium, Copper, Cadmium, Total or Each	=	1	mg/l
20. Other materials that should not discharge into the waste water pipeline - High viscosity material - Setteable solids that Cause pipe clogging - Calcium Carbide Sludge			
21. Synthetic Detergent	=	30	mg/l
22. Chloride (Cl) as Chlorine	=	2,000	mg/l

Table 2. Industrial Effluent Standards Ministry of Industry (1982)

Parameter	Allowable Concentration
1. pH	Between 5.0 and 9.0
2. Permanganate	60 mg/l
3. Dissolved Solids	
– Discharge into Water Course:	2,000 mg/l or more but not exceedin 5,000 mg/l depending upon discharging point
– Discharge into sea or estuaries (Salinity higher than 2,000 mg/l):	5,000 mg/l higher than dissolved sol content in sea or estuary water
4. Sulfide as H_2S	1.0 mg/l
5. Cyanide as HCN	0.2 mg/l
6. Heavy metals:	
– Zinc	5.0 mg/l
– Chromium	0.5 mg/l
– Arsenic	0.25 mg/l
– Copper	1.0 mg/l
– Mercury	0.005 mg/l
– Cadmium	0.03 mg/l
– Barium	1.0 mg/l
– Selenium	0.2 mg/l
– Lead	0.2 mg/l
– Nickel	0.2 mg/l
– Manganese	5.0 mg/l
7. Tar	Nil
8. Oil & Grease	5.0 mg/l (Except for crude oil refinery and lubricant blending plant: less than 15 mg/l)
9. Formaldehyde	1.0 mg/l
10. Phenols & Cresol	1.0 mg/l
11. Free Chlorine	1.0 mg/l
12. Insecticides and radioactive active substance	Nil

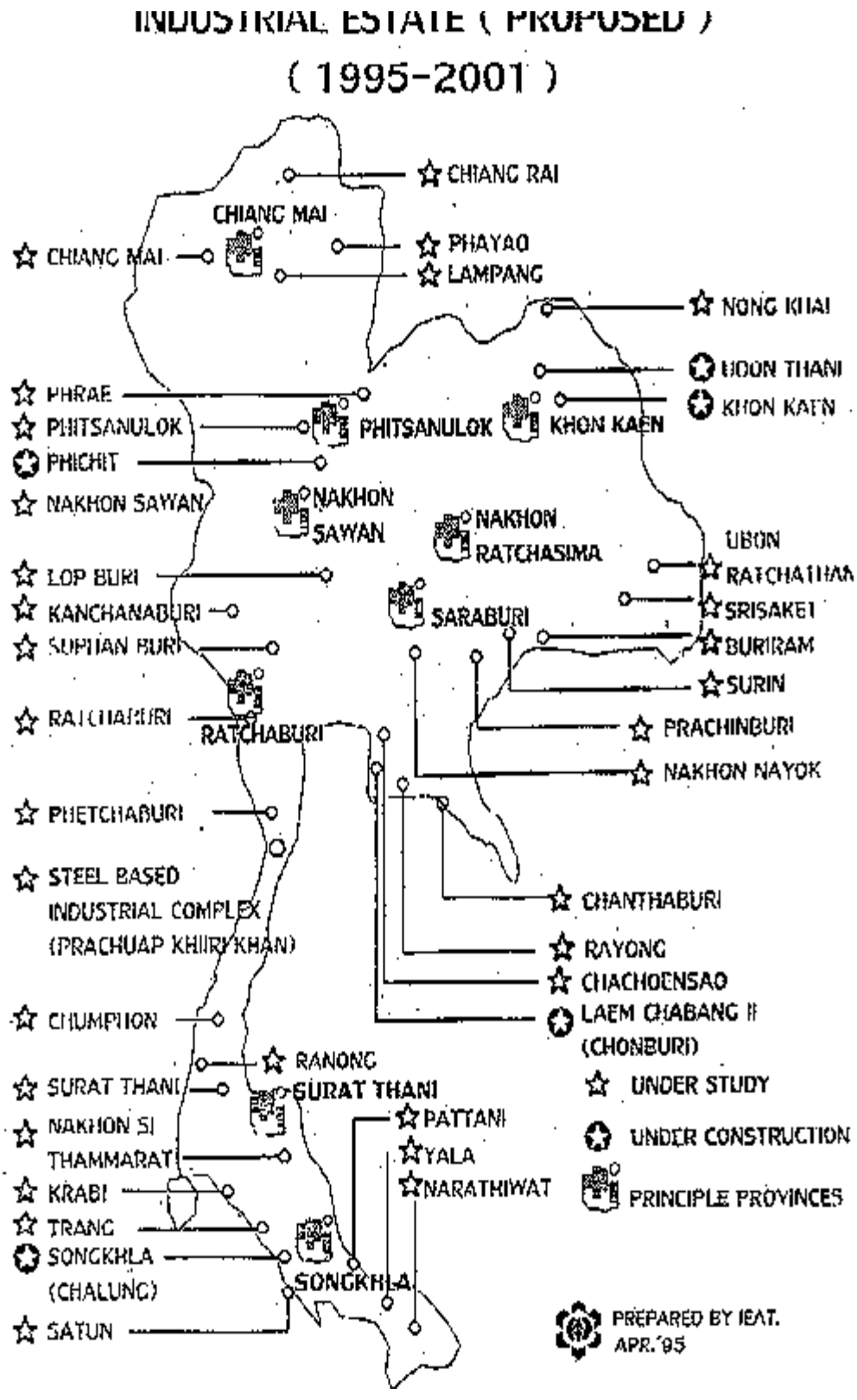
Table 3. Industrial Emission Standards by Ministry of Industry (B.E. 2536)

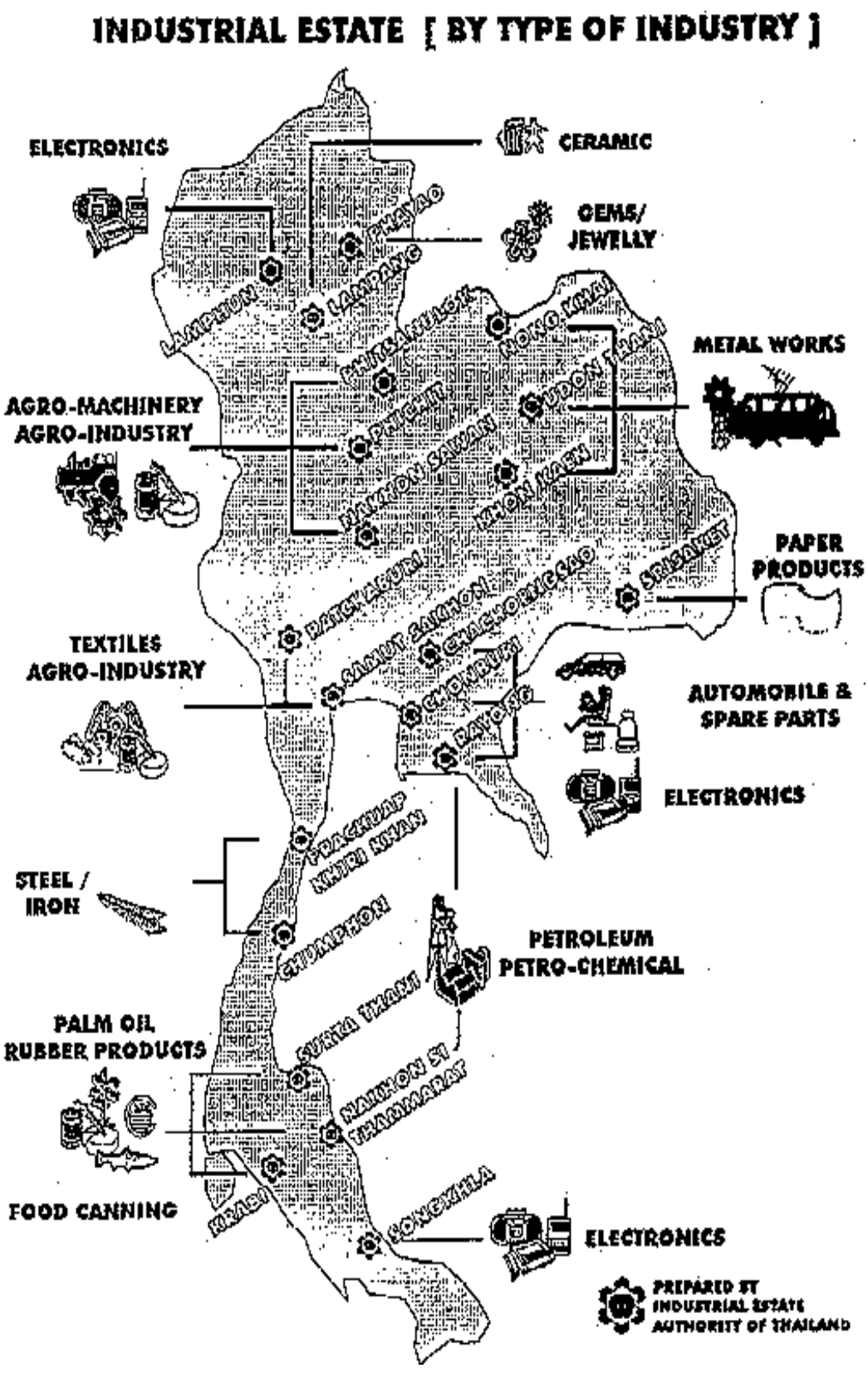
No.	Substances	Sources	Standard Values
1	Particulate	Boiler & Furnace	
		- heavy oil as fuel	300 mg/m^3
		- Coal as fuel	400 mg/m^3
		- Other fuel	400 mg/m^3
		- Steel or Aluminum Manufacturing	300 mg/m^3
		- Other source	400 mg/m^3
2	Antimony	any source	20 mg/m^3
3	Arsenic	any source	20 mg/m^3
4	Copper	Furnace or smelter	30 mg/m^3
5	Lead	any source	30 mg/m^3
6	Chlorine	any source	30 mg/m^3
7	Hydrogen Chloride	any source	200 mg/m^3
8	Mercury	any source	3 mg/m^3
9	Carbon monoxide	any source	1,000 mg/m^3 or 870 ppm
10	Sulfuric acid	any source	100 mg/m^3 or 25 ppm
11	Hydrogen Sulfide	any source	140 mg/m^3 or 100 ppm
12	Sulfurdioxide	H_2SO_4 production	1,300 mg/m^3 or 500 ppm
13	Oxides of Nitrogen (measure in NO_2 form)	Boiler	
		- Coal as fuel	940 mg/m^3 or 500 ppm
		- Other fuel	470 mg/m^3 or 250 ppm
14	Xylene	any source	870 mg/m^3 or 200 ppm

Remark: Standard Values are measured at 1 atm 25 °c from stack emission.

Table 4. Emission Loading of Map Ta Phut Air Emission for each industry

Parameter	Allowable Emission Loading kg/hectare-day
CO	2,579
NO_x	13
SO_x	13.5
TSP	7.5


INDUSTRIAL ESTATE (PROPOSED)
(1995-2001)
CHIANG RAI
CHIANG MAI
CHIANG MAI
PHAYAO
LAMPANG
NONG KHAI
UDON THANI
KHON KAEN
PHRAE
PHITSANULOK
PHICHIT
PHITSANULOK
KHON KAEN
NAKHON SAWAN
NAKHON SAWAN
NAKHON RATCHASIMA
UBON RATCHATHANI
SRISAKET
LOP BURI
KANCHANABURI
SUPHAN BURI
SARABURI
BURIRAM
SURIN
RATCHABURI
RATCHABURI
PRACHINBURI
NAKHON NAYOK
PHETCHABURI
STEEL BASED INDUSTRIAL COMPLEX (PRACHUAP KHIRI KHAN)
CHANTHABURI
RAYONG
CHACHOENSAO
LAEM CHABANG II (CHONBURI)
CHUMPHON
RANONG
SURAT THANI
SURAT THANI
NAKHON SI THAMMARAT
PATTANI
YALA
NARATHIWAT
KRABI
TRANG
SONGKHLA (CHALUNG)
SONGKHLA
SATUN
UNDER STUDY
UNDER CONSTRUCTION
PRINCIPLE PROVINCES
PREPARED BY IEAT.
APR.'95


INDUSTRIAL ESTATE [BY TYPE OF INDUSTRY]
ELECTRONICS
CERAMIC
GEMS/ JEWELLY
METAL WORKS
AGRO-MACHINERY AGRO-INDUSTRY
PAPER PRODUCTS
TEXTILES AGRO-INDUSTRY
AUTOMOBILE & SPARE PARTS
ELECTRONICS
STEEL / IRON
PETROLEUM PETRO-CHEMICAL
PALM OIL RUBBER PRODUCTS
FOOD CANNING
ELECTRONICS
LAMPHUN
LAMPANG
PHITSANULOK
PHICHIT
NONG KHAI
UDON THANI
NAKHON SAWAN
KHON KAEN
BANGKADI
SAMUT SAKHON
CHACHOENGSAO
SARABURI
CHONBURI
RAYONG
PRACHINBURI
NAKHON NAYOK
CHUMPHON
SURAT THANI
NAKHON SI THAMMARAT
KRABI
SONGKHLA
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