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International POPs Elimination Project

*Fostering Active and Efficient Civil Society Participation in
Preparation for Implementation of the Stockholm Convention*

Dioxin Hotspot Report - Case Study of Municipal Waste Incinerators in Phuket and Samui

**Campaign for Alternative Industry Network (CAIN),
Greenpeace Southeast Asia (GPSEA), Alternative
Agriculture Network (AAN)**

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About the International POPs Elimination Project

On May 1, 2004, the International POPs Elimination Network (IPEN <http://www.ipen.org>) began a global NGO project called the International POPs Elimination Project (IPEP) in partnership with the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP). The Global Environment Facility (GEF) provided core funding for the project.

IPEP has three principal objectives:

- Encourage and enable NGOs in 40 developing and transitional countries to engage in activities that provide concrete and immediate contributions to country efforts in preparing for the implementation of the Stockholm Convention;
- Enhance the skills and knowledge of NGOs to help build their capacity as effective stakeholders in the Convention implementation process;
- Help establish regional and national NGO coordination and capacity in all regions of the world in support of longer term efforts to achieve chemical safety.

IPEP will support preparation of reports on country situation, hotspots, policy briefs, and regional activities. Three principal types of activities will be supported by IPEP: participation in the National Implementation Plan, training and awareness workshops, and public information and awareness campaigns.

For more information, please see <http://www.ipen.org>

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I. Introduction to the Project

The management of municipal solid waste, hazardous waste and medical waste is a growing problem in Thailand. Despite efforts to prevent, reduce and recycle waste, proposals to construct new incinerators are being pushed in an attempt to provide a “quick fix” solution to the waste crisis. Incinerators contaminate the environment with persistent organic pollutants, particularly dioxins and furans, and other chemicals of equivalent concern, produce toxic ashes and other residues, and destroy resources that could have been reused or recycled. Annex C of the Stockholm Convention describes waste incinerators as having, “...the potential for comparatively high formation and release of these chemicals [dioxins, furans, PCBs, HCB] to the environment.”

In Thailand, there are currently two large-scale municipal waste incinerators operating in Phuket and Samui islands, having a capacity of 250 kg/h and 140 kg/h respectively. The dioxin hotspot report, undertaken by groups belonging to the Thai POPs Elimination Network (ThaiPEN), documents existing and potential health, environmental, social, and economical impacts from dioxins released from the said incinerators.

The aims of this project entitled “Dioxin Hotspot Report - Case Studies of Municipal Waste Incinerators in Phuket and Samui” are to:

1. Identify problems of dioxin pollution from two largest municipal solid waste incinerators in Thailand with the intent of raising both public and government awareness.
2. Make initial recommendations on how to address the problem as well as provide a framework for NGO involvement in government processes.

Thailand ratified the Stockholm Convention on Persistent Organic Pollutants on 31 January 2005. ThaiPEN views this as an indication of the country’s political commitment to protect public health and the environment from POPs, and anticipates corresponding actions by all stakeholders, especially the government, industry and the citizenry, to rid Thailand of these toxic chemicals.

II. Waste Issues and Trends in Thailand

Solid Waste Generation. The amount of solid waste has increased every year, particularly the proportion of waste that is difficult to process. Rampant consumerism has meant that waste generation has been greater than the provision made for it. An additional problem is the presence of hazardous waste mixed in with solid waste. Total solid waste throughout the country was 13.5 million tons in 1997, of which 24 percent came from Bangkok, 35 percent from other urban areas and the remaining 41 percent from rural areas.

Thailand's current solid waste management strategy focuses on bulk collection and mass disposal. The Thai government is implementing an "integrated waste management system" that includes waste sorting, composting, and incineration. Responding to the growing volume of waste, the Thai government set up a national policy to 1) improve solid waste disposal and processing procedures which may be achieved through privatization of waste eliminating works, 2) support and encourage proper solid waste separation, 3) encourage recycling and reuse, and 4) support local government to build up capacities for waste management.

Hazardous Waste Generation. According to figures released by the Pollution Control Department, in 1996 there were 1,634,104 tons of industrial wastes, estimated to rise to 2,813,980 tons in 2001. Currently only small proportion of industrial waste is treated correctly, whether in the factory or at a waste treatment center. The existing industrial waste treatment center can handle 360,000 tons per year – a small fraction of the amount generated. The remainders are stored for future treatment or illegally dumped in public places. Thus in any one year some 1 million tons of industrial waste remains untreated.

In 1997, the Industrial Works Department hired the CMS Engineering and Management Company and Rust International Inc of the USA to analyze and predict the increases in industrial waste over next 10 years. This estimation is to be used to draw up a Master Plan for the Elimination of Hazardous Waste by establishing an industrial waste management center in the provinces. The Ministry of Industry emphasized the incineration of hazardous waste as its component. The construction of a proposed industrial waste incinerator in Bang Poo industrial estate will cost 220 million Baht (US\$1=38 Baht) and will burn some 10,000-50,000 tons of waste per year.

Medical Waste Generation. The Thai institutions that deal with technical matters of medical waste management include the Pollution Control Department (PCD), the Department of Health (DH) and the Bangkok Metropolitan Administration (BMA). Each institution carries out its own functions rather independently. However, due to the differences in the definition of medical waste used by each institution, there are discrepancies in the basic data pertaining to hospital wastes, particularly with respect to the types and generation rate of wastes. Due to the reasons cited above, the waste generation rates issued by the BMA, DH and PCD are 0.11, 0.43 and 0.65 kg/bed/day respectively. In 1995 the DH commissioned a study on the disposal of hospital wastes by incineration, which revealed that the average waste-generation rate was 0.23 kg/bed/day.

By far the most common treatment method of medical waste in Thailand is incineration. Presently the Bangkok Metropolitan Administration (BMA) operates two 10-ton-per-day incinerators for the disposal of medical wastes in the Bangkok area. The Department of Public Hygiene, Ministry of Public Health, which oversees the disposal of wastes from hospitals under the Ministry's jurisdiction, has developed standard incinerator designs of 25, 50, and 100-150 kg/hr capacities. According to DH, there are 750 medical waste incinerators installed in hospitals under the jurisdiction of the Ministry of Public Health

Status of Waste Incineration Schemes in Thailand

List of Incinerators in Operation, Being Constructed or Proposed in Thailand

Name	Status	Type of waste	Capacity	Costs (million USD)	Remark
Phuket Municipal Waste Incineration Plant	Operational	MSW	250 ton/day	25	Contractor – MC Incinerator and Mitsubishi Industry. Operated by Palcon-Monteney
Samui Municipal Solid Waste Incineration Plant	Operational	MSW	140 ton/day	3.5	Contractor – NKK Engineering. Operated by Palcon-Monteney
Waste-to-Energy Plant in Chaeng Mai	Canceled (because of local protest)	MSW	300 tons/day	50	Svaerner Enviro Power, a Swedish subsidiary of the Norwegian engineering company, has been working with the Provincial Electricity Authority and intended to build 40 incinerators over the course of ten year
On Nut Waste-to Energy Plant Phase I (Bangkok)	Proposed	MSW	1350 tons/day	125	Source of loan –JBIC
On Nut Waste-to Energy Plant Phase II (Bangkok)	Proposed	MSW	1350 tons/day	125	Source of loan –JBIC
Nongkhaem Waste-to-Energy Plant (Bangkok)	Proposed	MSW	1350 tons/day	125	Source of loan –JBIC
Tha Reang Waste-to-Energy Plant (Bangkok)	Proposed	MSW	1350 tons/day	125	Source of loan –JBIC
BMA Hospital Waste Incinerator	Operational	Medical Waste	20 tons /day	3.0	Australian Technology
Mobile Incinerator	Unknown	Medical Waste		0.2	Donated by Kayowa Kako Co.
Royal Palace Incinerator	Unknown	Solid Waste	Unknown	Unknown	Gift from the President of Finland using Finnish equipment and technology from IVIO and ECOTEC.
Bang Poo Industrial Waste Incinerator	Proposed	Industrial Waste	10,000 - 50,000 tons/year	5.5	Unknown
Amata Nakhorn Industrial Estate, Chonburi	Operational	Solid waste	9 tons/day	Unknown	Kijja Consulting Engineers MMC-750
Chonburi Industrial Estate (Bowin), Chonburi	Currently shut down, as it reached the end of its operating life in May 2000	Solid Waste	6 tons/day	Unknown	Kijja Consulting Engineers IMC-500
GK Land Industrial Park, Rayong	Undergoing commissioning. Not yet fully operational due to lack of waste.	Solid Waste	-	Unknown	Hovelwerk AG Type GG24/BS72/ TR24 two stage incinerator
Gateway City Industrial Estate, Chachoengsao	Operational	Solid Waste	20 tons/day	Unknown	Kijja Consulting Engineers
Laem Chabang Industrial Estate, Chonburi	Not in use as not economical to operate.	Solid Waste	8 tons/day	Unknown	UNKK
Rojana Industrial Park, Rayong	Proposed.	Solid Waste	Up to 4 tons/day	Unknown	Goshu Goshan
Siam Eastern Industrial Park, Rayong	Operational	Solid Waste	7 tons per day, 1 day per week	Unknown	K.K. Katotekko Burner Seisakusho Co. Ltd. Model GPN 20
Wellgrow Industrial Estate, Chachoengsao	Operational	Solid Waste	Up to 14.7 tons per day, six days per week	Unknown	Goshu Goshan CX-500

Source : Greenpeace, CAIN.

all over country. Most of these incinerators have deteriorated, prompting the Department of Public Hygiene to start importing incinerators to replace the old ones.

III. The Samui Waste Incinerator

The Samui Municipal Waste Incineration Plant is located in the area of Kok Khanon Village, Na Muang sub-district, Samui Island in the Province of Surat Thani. It was built in 1997 for 501 million Baht (\$13.5 million USD) through a joint Thai-Japanese venture involving Palcon Co. and NKK. The incinerator construction was funded by a grant to the Public Works Department by the Japanese Overseas Economic Cooperation Fund (JOECF) or what is known today as the Japan Bank for International Cooperation (JBIC).

Once they said it is “state of the art,” now the incinerator that is oddly constructed in the world famous tropical paradise called Samui Island in Surat Thani province is crumbling.

From the beginning the Thai French group Palcon-Montaney managed the incinerator, which cost the government an additional cost of about 50 million Baht (US\$1=38 Baht) per year. The incinerator has full capacity to burn 140 tons of garbage per day and can run at a minimum of 75 tons per day.

But since the small island resort does not generate 140 tons of garbage daily, the incinerator uses only one furnace and burns garbage only every 10 days, with rest and maintenance days in between burning periods.

A feasibility study report financed by the Department of Public Works in 1993 estimated that for the year 2000, Samui will be generating about 72 tons of garbage daily, only about half of the full projected capacity of the incinerator. Even in the year 2011, the projected daily garbage generation rate for the island is pegged at 114 tons per day – less than the incinerator capacity. This has fueled speculations that the resort island would end up importing garbage from nearby provinces in the short term to be able to run the incinerator at full capacity and justify the tremendous expense that went into the construction and operation of the facility.

The incinerator has been experiencing frequent shut downs because of inadequate power supply in the island. There are also concerns about the disposal of ashes from incinerator, which could contaminate ground water supplies.

With millions of baht in annual losses, it is no wonder that the Thai-French company Palcon-Montaney quietly abandoned the incinerator at the hands of CUB Co. Ltd., a Thai company, to carry on the operations. Not that the latter really has something to work on – the incinerator manages to gather a measly 60 tons of trash a day that, for a long time, it could not justify running its two highly expensive burners daily and at full capacity.

When the municipal government and the Department of Public Works rushed in their thoughtless approval of this incinerator, they projected that the facility, which can burn

up to 140 tons of trash daily, would generate money and electricity. Nowadays, the incinerator sits in the middle of island slowly rotting under Samui's beautiful sunshine.

Economic costs

The 501 million Baht (\$13.5 million USD) yearly bill that the government pays for the operation of the incinerator essentially means that the taxpayers are currently paying Palcon-Montaney a whopping 149,449 Baht per day (US\$3,795) to burn a ton of waste daily (at the projected 47 ton per day generation rate for Samui). Instead of boosting the local economy of Samui, these exorbitant tipping fees are generating more money for the incinerator operators, who would naturally want to increase their daily burning rates to hike their profits. From the perspective of incinerator operators, burning more garbage means generating more profits, making incineration contradictory with waste reduction and recycling.

Waste and Tourism

Residents on the island number over 40,000. In terms of waste generation, the tourists would be responsible for churning out a large portion of Samui's total waste output. The Department of Public Work feasibility study for Samui, for instance estimated approximately that 8,625 hotel rooms alone in the current year would generate about 26 tons per day, about a third of the total garbage generates in the island. For example, each Thai resident of Samui generates around 1.18 kg of trash per day, while a single hotel room generates 2.9 kg per day.

IV. The Phuket Waste Incinerator

Phuket's garbage problem rapidly accelerated in the early 1980s with the growth of tourism in the region. As an international tourist destination, Phuket currently attracts around two million visitors each year. These tourists generate about 120 tons of solid waste each day.

In 1993, Pal Consultants was hired by the Department of Public Works to study the garbage problem. Their study included consideration of landfill, composting and incineration but did not look at waste segregation or recycling. It recommended the construction of a 250 ton per day waste-to-energy incinerator. In 1995, the national government provided 788 million Baht to construct such an incinerator, and requested the Department of Forestry to allocate mangrove lands for the site.

The successful construction bidder was the Japanese corporation Mitsubishi, who utilised technology and erection expertise from German-based Martin and MC Incineration Co. respectively. Pal Consultants Co, Creative Technology Co and Norconsult International Co. were hired by the Department of Public Works to supervise the project.

Several environmental regulations were violated in the construction of the Phuket incinerator, including a law which bans the construction of buildings over 12 meters in

the Phuket area and the factory work law which requires that incinerators, classified as central waste treatment, be examined by the factory work department. Further, the Environmental Impact Assessment study prepared for the Department of Public Works was not submitted to the Ministry of Science and Technology for consideration, as is required by law.

The incinerator came online in early 1999, but is only run every two or three days when sufficient garbage is accumulated to permit full operation.

V. Samui and Phuket Incinerators and Environmental Pollution

In December 2004, Greenpeace Southeast Asia found out that, according to a feasibility study done by CUB Co. Ltd., a very high concentration of cancer-causing chemical dioxins has been released from the Samui incinerator. Dioxin emission has gone far beyond the standard set by Ministry of Natural Resources and Environment; in fact by more than 100-fold. The data indicate the need for the Ministry to shut down the incinerator if it cannot operate in compliance with Thai law. In addition, after ratification of Stockholm Convention in January 2005, this represents an urgent need for Thailand to implement a dioxin elimination plan that examines the larger issues of waste management.

Dioxin Measurement from Samui Waste Incinerator Stack by SGS (Thailand):

Date	Dioxin (total) Standard = 30 ng/Nm ³		Dioxins and Furans-TEQ Standard = 0.5 ngTEQ/Nm ³	
	Measured	Adjust O ₂ 7%	Measured	Adjust O ₂ 7%
May 7, 2003		202.1		0.9
August 2, 2003	4254	7301	21.19	36.37
December 12, 2003	1,329	2,309	12.30	21.37
January 21, 2004	1,469	2,552	14.77	25.67
May 19, 2004	1,712	2,867	16.57	27.76

Source : Feasibility Study Report on Dioxin Reduction Guideline for Samui Municipal Waste Incinerator, 2004 done by CUB Co.Ltd.

An analysis done by Greenpeace in 2000 of the fly ash samples taken from the incinerator detected elevated levels of lead and cadmium, reflecting significant lead and cadmium content of materials being incinerated. Lead levels found in the fly ash were 1,020 mg/kg or parts per million, up to 120 times higher than levels of lead which might be expected in uncontaminated soils (10-30 mg/kg). Cadmium levels in the ash were also about 80 times higher than normal background levels.

Other heavy metals such as mercury, copper, chromium were also identified in the sample along with complex mixtures of non-chlorinated hydrocarbons and other organic chemicals.

Pollutant Profile of Samui Waste Incinerator

1. Lead – found in ash up to 120 times above background levels.
2. Cadmium – found in ash up to 80 times above uncontaminated background levels.

Pollutant Profile of Phuket Waste Incinerator:

1. Lead – up to 105 times above background levels.
2. Copper – up to 40 times above background levels.
3. Cadmium – up to 21 times above background levels.

Lead is toxic to most living things. In humans it is associated with a wide range of adverse effects including nervous system disorders, anemia, heart disease, disorders in bones and reproduction. Of particular concern is the effect of relatively low exposure in cognitive and behavioural development in children.

Long term elevated exposure to copper can be harmful. Inhalation of dust and vapours can irritate the nose, mouth and eyes and cause headaches, dizziness, nausea and diarrhea. Extreme exposure can cause coma and death.

Cadmium has no biochemical or nutritional function, and it is highly toxic to both plants and animals. Cadmium and certain cadmium compounds are listed by the International Agency for Research on Cancer (IARC) as carcinogenic. Cadmium is also toxic to the liver and has been linked with hypertension and heart disease.

VI. Follow-Up Plans

ThaiPEN will continue to update and complete the dioxin hotspot report involving Thailand's only two large-scale operating municipal waste incinerators. Community interviews and discussions are being planned to further assess the impacts of dioxin pollution, and promote the consideration of alternative solutions. Once completed, the report will be publicly launched.