www.ipen.org ipen@ipen.org

International SAICM Implementation Project (ISIP)

In 2010, in an effort to demonstrate SAICM implementation via IPEN Participating Organizations, IPEN launched an International SAICM Implementation Project, also known as ISIP. ISIP aims to mobilize resources for initial enabling activities pertaining to national priorities, in keeping with the work areas set out in the strategic objectives of section IV of the SAICM Overarching Policy Strategy.

In particular, the ISIP supports the Governance objective of SAICM's Overarching Policy Strategy paragraph 26, which calls for enhanced "cooperation on the sound management of chemicals between Governments, the private sector and civil society at the national, regional and global levels."

In addition, ISIP builds on the 2008-2009 Global SAICM Outreach Campaign to raise awareness about SAICM and strengthen collaboration among the public interest, health and labor sectors.

ISIP Objectives

ISIP's four objectives include:
• Promoting the need for sound chemicals management
• Advancing National SAICM Implementation
• Promoting global SAICM implementation by global civil society
• Building capacity among NGOs developing countries and countries with economies in transition

Title of activity: Mapping toxics in surrounding of Phuket as a contribution to global debate about POPs in wastes
NGO: Ecological Alert and Recovery – Thailand (EARTH)
Country: Thailand
Date: August 2011

Elements of SAICM Covered:

Identify, explain problem, make initial recommendations on how to address the problem, may be linked to public awareness-raising about the issue; Facilitate the identification and disposal of obsolete stocks of pesticides and other chemicals (47, 68)

Provide a physical description of the site

There are two waste incinerators in Phuket, a larger one burning municipal waste, and a smaller one burning medical waste, but working only occasionally (according to information from an elderly lady living next door to the medical waste incinerator). Close to the waste incinerators is also a garbage dump.

The Phuket landfill/incinerator complex is located along side the BangYai canal downstream from the city and close to its confluence with the sea. The whole complex was built in a mangrove wetland. More detailed information about the situation can be seen in the map below.

The municipal waste incinerator was constructed with a capacity of 250 tons/day (91 thousand tons per year), but according to the data in an article published in 2004, it burned 233 tons/day, 85.5 thousand tons per year. Fly ash was produced in the amount of almost 2 thousand tons and bottom ash in the amount of 15,5 thousand tons per year, according to the same article (Liamsanguan and Gheewala 2004). During our visit in December 2010, a new municipal waste incinerator was under construction next to the operating one.

Picture 1:

A description of the complex given from a Greenpeace report from 2000 states: *"The municipal waste incinerator underwent test burns between April and June 1998. Bottom ash/clinker and fly ash from these operations had been dumped or stored in ash pits constructed within the boundaries of the complex. The storage area containing bottom ash residues was partly filled with water, giving it the appearance of a waste lagoon. The visible presence of glass medical waste containers within one area of this lagoon suggested that bottom ash from the incineration of medical waste had also been dumped there; this was confirmed by the manager of the medical waste incinerator."*(Labunska, Stephenson et al. 2000).

The waste incinerator in Phuket sends fly ash for specific land-filling. According to the Greenpeace report (Labunska, Stephenson et al. 2000), there has been land-filling next to the waste incinerator (together with bottom ash) for a long time. Fly ash was found by a Swedish scientist during his sampling in 2009 in the area close to waste incinerator (UU 2009). At least part of the landfill with fly ash was most likely removed during the construction of the new waste incinerator. By comparing a current photomap from Google Earth with another one from 2007, one can see that the area has changed during the years (see Picture 2).

Picture 2: By comparing the photomap from 2007 (left side) with that from 2010 (right side), it becomes clear that land use has changed around the waste incinerator in Phuket. The large grey area at the south east edge of the incinerator was an area filled with fly ash dumping in 2007.

Give a history of the site

The Phuket Waste Incinerator was built due to the fact that 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 utilized 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 that bans the construction of buildings over 12 meters in the Phuket area and the factory work law that requires that incinerators, classified as central waste treatments, 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 *(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), March 2006).*

Description of the chemical characterization

Fly ash has been sampled several times at Phuket municipal waste incinerator. The first time it was sampled was by Greenpeace in 1999 for analyses of heavy metals and screening analysis for organic compounds (PCDD/Fs were not followed); (Labunska, Stephenson et al. 2000). Later on it was analyzed for PCDD/Fs within the study by Fiedler (UNEP Chemicals); (Fiedler

2001); although it is not specified in the report, it is clear that the Phuket municipal waste incinerator was sampled, because of the size of its capacity and because there was no other municipal waste incinerator that size in the years 2000/2001 (when sampling had to occur) in Thailand. The levels of dioxins measured in fly ash ranged between 228 – 686 pg I-TEQ/g and bottom ash 5 and 10,6 respectively.

Swedish Umea University has also undertaken a study of the Phuket waste incinerator residues on their dioxin and dioxin-like PCBs content. They found PCDD/Fs, dl-PCBs and sum of PCDD/F + DL PCB in TEQ levels in fly ashes ranging from 2,140 up to 8,230, from 47 up to 248 or from 2,180 up to 8,490 pg TEQ g^{-1} dry weight respectively. Levels observed in bottom ash directly sampled at the incinerator were 5.7, 0.16 or 4.3 pg TEQ g^{-1} dry weight respectively (UU 2009).

A second analyses for dioxin levels in fly ash revealed they are very close to those observed in untreated fly ash (Petrlik and Ryder 2005).

Description of the environmental and health consequences

There are no reliable studies on health impacts closely related to the Phuket Waste Incinerator, but there are a number of news reports about the negative environmental consequences that have been linked to the leachate from the waste landfill and the fly ash dumping site. On June 24, 2007, a Phuket local news agency reported from June 22, 2007, after days of heavy rain fall, there was large amount of leachate with a strong, foul smell from the municipal landfill running down to the sea and mangrove areas nearby. The leachate had contaminated the canal water, which, connecting to the open-sea, killed numerous fish, shells, and crabs being raised along the canal, and brought a huge loss to the local fishing farmers. It was estimated that at least 10 million baht was lost with the dead fish. Approximately 25 fishing farms filed demands against the Phuket Municipality and the Mayor for compensation for their loss. Samples of water were taken for laboratory testing but no results were released to the public.

Description of who is responsible for the site

The Municipality of Phuket is responsible for the site.

Description of the plans for cleanup

No action plan or local policy for clean-up of the contaminated area is known.
The municipality office has hired a waste expert to develop an action plan and measures to build-up better efficiency in collecting and separating garbage from target sources, including a plan to build one more incinerator in order to cope with the rapidly increasing volume of garbage and to prevent waste leftover and its putridity.

Project Outcomes:

Description of the activity conducted

Sampling in December 2010

Arnika Association (led by Jindrich Petrlik) from Czech Republic and the team of EARTH (Ecological Alert and Recovery - Thailand) led by Penchom Saetang, Walaiporn Mooksuwan and Arpa Wangkeit sampled ashes, sediment and biota in the surrounding area of the Phuket waste incinerators in December, 2010. On 10th December we went to look at the site and to interview local fishermen as well as other local residents and to see potential sampling sites. On 11th December we took samples of what we thought was a mixture of fly ash and bottom ash, according its consistency. We also took samples of sediments in the mangrove area near the outlet from the waste management complex area (see the star sign at map on Picture 1).

Local fishermen caught some crabs and fish at two sites in the sea bay near the waste complex area. They are marked in the map at Picture 3: 1) bay east from canal (approx 800 m from the shore) and 2) bay near mangrove (approx 500 m from mangrove). Local residents, who used to

pick food in the mangrove area, provided us with samples of shellfish, crabs and fish from two other sites: 3) mangrove area next to the waste complex and 4) river mouth south from the waste complex. Two days later local residents also picked samples of two bird eggs. They did not recognize which species the birds were, but most likely some passerine birds.

Map Ta Phut industrial area

After the visit at Phuket we went to do some sampling in the Map Ta Phut industrial zone, Rayong Province to obtain some additional data from Thailand, rather than have only a really broad picture. In Map Ta Phut a broad range of petrochemical industries and power plants are located, dedicated to serve primarly as energy sources for this complex. Our sampling zone was located in the bay close to a coal firing power plant and discharge canal from chemical factories. Discharged waste waters come from petrochemical factories including chlorine and PVC production. Pictures of the area are in Annex 1 with photos.

Biota samples were put into cooling boxes and frozen in EARTH's office afterwards. They were kept frozen except for during flights and transport from Thailand to the Czech Republic and from the Czech Republic to Netherlands. Bird eggs were boiled before they were transported for analyses. *Photos below show different kinds of fish and crabs collected as biota samples for testing.*



Picture 3: Map showing sampling sites in Phuket at Google Earth map. Both waste incinerators and eggs sampling area are marked by pins sign, other sampling areas are marked by red lines with their names in yellow, black and white letters.

Table 1: Overview of samples taken during joint EARTH/Arnika visit in Phuket and Map Ta Phut areas, Thailand in December 2010. The same numbering of samples is used in following tables with results of chemical analyses.

Number	Locality	Date of sampling	Matrix	Specie(-s)	Amount/sample	Analyses	Specification
P1/Fish 1	Phuket - mangrove	11-Dec-2010	Fish	Spotted scat (Scatophagus argus)	One fish	PCDD/F + DL PCB (DR CALUX); mercury	Caught in mangrove wetland by local boy
P2/Crabs 1	Phuket - mangrove	11-Dec-2010	Crabs	Mud crab, mangrove crab (Scylla serrata)	2 crabs/pooled sample	PCDD/F + DL PCB (DR CALUX)	Caught in mangrove wetland by local boy
P3/Shellfish 1	Phuket – river mouth	11-Dec-2010	Shellfish	Oyster	larger amount of oysters/pooled sample	PCDD/F + DL PCB (DR CALUX)	Picked up by local people in the river mouth - south from the dumpsite and waste incinerator
P4/Shellfish 2	Phuket - mangrove	11-Dec-2010	Shellfish	Green lipped sea mussel (Perna canaliculus)	Larger amount of mussels/pooled sample	PCDD/F + DL PCB (DR CALUX)	Picked up in mangrove wetland by local boy
P5/Fish 2	Phuket - bay east from the canal	11-Dec-2010	Fish	Blacktip catfish (Plotosus lineatus)	One fish	PCDD/F + DL PCB (DR CALUX); mercury; HCB	Caught in the sea bay cca 500 m from the shore by local fishermen
P6/Crabs 2	Phuket – bay near mangrove	11-Dec-2010	Crabs	Mud crab, mangrove crab (Scylla olivacea)	3 crabs/pooled sample	Mercury; HCB	Caught in the sea bay cca 500 m from the shore by local fishermen
P7/Crabs 3	Phuket – bay near mangrove	11-Dec-2010	Crabs	Blue swimmer crab (Portunus pelagicus)	4 crabs/pooled sample	PCDD/F + DL PCB (DR CALUX)	Caught in the sea bay cca 500 m from the shore by local fishermen
P8/Fish 3	Phuket – bay near mangrove	11-Dec-2010	Fish	Black jew (Protonibea diacanthus)	2 fish/pooled sample	Mercury	Caught in the sea bay cca 800 m from the edge of mangrove area by local fishermen
P9/Fish 4	Phuket – bay near mangrove	11-Dec-2010	Fish	Lattice monocle bream (Scolopsis taeniopterus)	7 fish/pooled sample	Mercury	Caught in the sea bay cca 800 m from the edge of mangrove area by local fishermen
P10/Fish 5	Phuket – bay near mangrove	11-Dec-2010	Fish	Needlefish; belonidae family	2 fish/pooled sample	PCDD/F + DL PCB (DR CALUX); mercury; HCB	Caught in the sea bay cca 800 m from the edge of mangrove area by local fishermen
P11/Sediment	Phuket – near the waste incinerator	11-Dec-2010	Sediment	Sediment from mangrove wetland	Sediment/pooled sample	PCDD/F + DL PCB (DR CALUX)	There were taken 10 individual samples 2 - 10 cm deep at 5x20 m area and homogenized
P12/Ash 1	Phuket - near the waste incinerator	11-Dec-2010	Bottom ash	Mixed ash with some small unburned waste pieces	Ash/pooled sample	PCDD/F + DL PCB (DR CALUX)	There were taken 10 individual samples 2 - 10 cm deep at 3x5 m area and homogenized

P13/Ash 2	Phuket - near the waste incinerator	11-Dec-2010	Botto m ash	Mixed ash with some small unburned waste pieces	Ash/pooled sample	PCDD/F + DL PCB (DR CALUX)	There were taken 10 individual samples 2 - 10 cm deep at 2x1 m area and homogenized
P14/Bird eggs	Phuket – Down	13-Dec-2010	Bird eggs	Most likely some passerine birds	2 boiled eggs/pooled sample	PCDD/F + DL PCB (DR CALUX)	From garden at living zone cca 2 km north north west from waste incinerator.
M1/Fish 6M	Map Ta Phut - Ko Saket	14-Dec-2010	Fish	Fourfinger threadfin (Eleutherone ma tetradactylum)	One fish	Mercury; HCB	Caught close to Ko Saket island by local fishermen
M2/Shellfis h 3M	Map Ta Phut – bay	14-Dec-2010	Shellfi sh	Green lipped sea mussel (Perna canaliculus)	Larger amount of mussels/pool ed sample	PCDD/F + DL PCB (DR CALUX)	Picked up in the bay close to coal power plant by local fishermen
M3/Shellfis h 4M	Map Ta Phut – bay	13-Dec-2010	Shellfi sh	Green lipped sea mussel (Perna canaliculus)	Larger amount of mussels/pool ed sample	Mercury; HCB	Bought at fish market close to coal power plant on the shore next to chemical industry area

Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) and dioxin-like PCBs (DL PCBs)

Two ash samples, one sediment, three fish samples, two shellfish samples, two crab samples, and bird eggs from Phuket as well as one shellfish sample from Map Ta Phut were analyzed for PCDD/Fs and DL PCBs in Bio Detection Systems (BDS) laboratory in Amsterdam, Netherlands by DR CALUX[1] method. Results of the analyses are given in Tables 2 and 3.

Table 2: Overview of results of analyses for PCDD/Fs and DL PCBs by DR CALUX method.

Locality	**Sample**	**CALUX TEQ** (pg TEQ/g fat)
Phuket - mangrove	Fish 1	42,5
Phuket - mangrove	Crabs 1	43,6
Phuket - river mouth	Shellfish 1	34,6
Phuket - mangrove	Shellfish 2	3,0
Phuket - bay	Fish 2	<LOQ (13)
Phuket - bay	Crabs 3	119,6
Phuket - bay	Fish 5	<LOQ (10)
Phuket - town	Eggs	6,1
Locality	**Sample**	**CALUX TEQ** (pg TEQ/g dry matter)
Phuket - near waste incinerator	Ash 1	3,9

[1] For the method DR CALUX and the parameter PCDD/PCDF and dl-PCBs (only total TEQ) the used method is extraction with organic solvents; the extracts are cleaned on an acid silica column. The cleaned extracts are dissolved in DMSO. The DR CALUX activity is determined (24h exposure) and benchmarked against 2,3,7,8-TCDD. The DR CALUX analysis is done according to p-bds-051. All DR CALUX analysis results comply with EU requirements as indicated in COMMISSION REGULATION (EC) No 1883/2006 (laying down the sampling methods and the methods of analysis for the official control of dioxins and the determination of dioxin-like PCBs in foodstuffs. Intralaboratory repeatability and reproducibility are less than 15 and 30% respectively.

Phuket - near waste incinerator	Ash 2	4,3
Phuket - mangrove	Sediment	24,5

Levels of PCDD/Fs + DL PCBs found in sampled ashes are not very high compared to those observed in both the Umea University report (UU 2009) and Fiedler's report (Fiedler 2001). Although we thought there was a mixture of fly ash and bottom ash landfilled next to the lagoon between two waste incinerators, the levels of dioxins and dioxin-like PCBs were very low and it seems there was either only bottom ash during our sampling, or dioxins were already diluted from the ashes which lay there a longer time. Another explanation could be that the ashes were mixed with soil and dumped here afterwards.

PCDD/Fs + DL PCBs in sediment from mangrove area were found at level of 24.5 CALUX-TEQ g^{-1}. There isn't any available data about dioxin-like compounds levels in marine sediments.

Impact on target groups:

The aim of the project was to evaluate and highlight the potential influence of waste incineration residues handling in the Phuket waste incinerator on the food chain in its surroundings. This project will contribute to the global discussion about POPs in wastes and set up of proper limit values for POPs in wastes. The results will also contribute to national implementation of the Stockholm Convention. Representatives of national governments and other stakeholders at international meetings on POPs are major target groups of our project. Secondary target groups include NGOs, mass media and the general public in Thailand.

Main activities:

1) Sampling of biota in the surrounding area of Phuket waste incinerator – fish, poultry and poultry products.
2) Analyses for dioxins (PCDD/Fs) and dioxin-like PCBs in certificated laboratory in EU.
3) Collecting available data on Phuket waste incinerator.
4) Evaluation of the results – brief report.
5) Sharing of the outcome with other NGOs in IPEN.

Impact on target policies:

Our project will contribute to the discussion about the levels of POPs in wastes, which is a substantial topic related to the set up of "low POPs content" levels under international conventions – Stockholm Convention and Basel Convention. The NGO community is fighting for stricter limits on POPs in wastes in order to prevent environmental contamination by POPs.

Our project relates to several SAICM global plan of action items:

78. Facilitate the identification and disposal of obsolete stocks of pesticides and other chemicals (especially PCBs), particularly in developing countries and countries with economies in transition.

80. Prevent and minimize hazardous waste production through the use of alternatives that pose less risk.

65. Eliminate by 2020 the production and use of hazardous chemicals identified as persistent bioaccumulative substances, endocrine disruptors, chemicals that are carcinogenic, mutagenic or toxic to reproduction and heavy metals posing serious risk for human health and the environment.

Deliverables, outputs and/or products:

This project will help to encourage negotiators of international conventions related to POPs waste to prepare and accept stricter limit values for POPs in wastes. We also hope that outcomes of this project can encourage our government:

1) to carry out more measurements of dioxin compounds in the Thai environment by showing a potentially less expensive way of measurements, and
2) to pay more attention to POPs levels in the Thai environment as well as to pay more attention to alternative waste management such as zero waste practice.

EARTH itself has learnt from this project how to generate data needed for their campaigns and projects in cooperation with international networks and how to use these data. We hope also that this project will enlarge our cooperation with NGOs based in EU countries.

Communication Efforts:

At the moment of this report writing we are still waiting for the dioxin analysis and comments from experts. Therefore the final report is not finished and cannot be released to the media. However when the final version is completed we will set up an educational campaign based on the facts and figures we get from this study to raise public concern and stimulate the responsible agencies to take appropriate steps in countering it.

SAICM National Focal Point:

Pollution Control Department (PCD)
Ministry of Natural Resources and Environment.
92 Phahonyothin Rd, Phayathai,Bangkok 10400, Thailand
Tel 66 2298 2442/2439 Fax 66 2298 2442
http://www.pcd.go.th , http://pops.pcd.go.th

NGO Recommendations for next steps:

Our project shows an example of cooperation between NGOs based in South East Asia and NGOs in EU countries, which can be a base for much larger projects in the future. At the same time our project can be used as an example for similar hot spots anywhere in the world. It is a pilot project in the way that NGOs can follow POPs in waste incineration residues- this is not a very common case, therefore it can be used as an example for similar projects. Others can learn from our experience, both good and bad, which will show up during the project.

This project also supports IPEN's activities on the field of POPs waste. Its outcomes may help to strengthen IPEN's position in international negotiations on more strict set up of so called "low POPs content" – a standard which can influence flows of POPs wastes from developed countries to the developing world and which can badly affect environment and health in developing countries hot spots.