



Mercury Situation in Thailand

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Occupation that exposed to mercury

1. **Mercury mine**
2. **Gold mine**
3. **Pesticide manufacturing**
4. **Medical or Scientific Measurement equipment**
5. **Electrical equipment manufacturing and Fluorescent**
6. **Medicine manufacturing**
7. **Chemical manufacturing such as acetic acid, soda ash**
8. **Working with mixing the metal such as amalgam**
9. **Choline manufacturing that use mercury as catalyst**
10. **Wool manufacturing that use mercury as softener**
11. **Paints manufacturing**

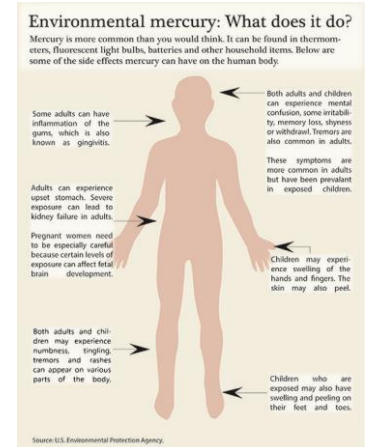


 **MERCURY POISONING & ALZHEIMER'S DISEASE**
IT ISN'T A COINCIDENCE

SYMPTOMS OF MERCURY POISONING	SYMPTOMS OF ALZHEIMER'S DISEASE
IRRITABILITY	IRRITABILITY
ANXIETY	ANXIETY
DEPRESSION	DEPRESSION
MEMORY LOSS	MEMORY LOSS
AGITATION	AGITATION
PHYSICAL OR VERBAL OUTBURSTS	PHYSICAL OR VERBAL OUTBURSTS
EMOTIONAL DISTRESS	EMOTIONAL DISTRESS
RESTLESSNESS	RESTLESSNESS
SLEEP DISTURBANCES	SLEEP DISTURBANCES
DELUSIONS	DELUSIONS

WHO mercury poisoning

- Mercury is a naturally occurring element that is found in air,
- water and soil.
- Exposure to mercury – even small amounts – may cause serious health problems, and is a threat to the development of the child *in utero* and early in life.
- Mercury may have toxic effects on the nervous, digestive and immune systems, and on lungs, kidneys, skin and eyes.
- Mercury is considered by WHO as one of the top ten chemicals or groups of chemicals of major public health concern.
- People are mainly exposed to methylmercury, an organic compound, when they eat fish and shellfish that contain the compound.



Occupational and Environmental Toxicology of Mercury and Its Compounds

Hiroshi SATOH: Industrial Health 2000, 38, 153–164

- Classical mercury poisoning is characterized by a triad of signs, namely tremors, erethism and gingivitis.
- Mercurial erethism, which is characterized by behavioral and personality changes such as extreme shyness, excitability, loss of memory, and insomnia are also observed.
- Recently, the effects of mercury exposure at levels around 0.05 mg/m³ or lower have been of concern and may include minor renal tubular damage, increased complaints of tiredness, memory disturbance and other symptoms, subclinical finger tremor, abnormal EEG by computerized analysis and impaired performance in neurobehavioral or neuropsychological tests.
- Abnormal gait, dysarthria, ataxia, deafness and constriction of the visual field are typical of the symptoms of methylmercury poisoning observed in Minamata and Iraqi outbreaks, as well as in occupational methylmercury poisoning cases.

Mercury Intoxication in Thailand

- First report of Mercury toxicity in Thailand was in 1953 by Dr. Sombat Sukontaphan, two patients were toxicated by mercury fumicant as an medicine and one died.
- Surveillance reports in Thailand come in the combination of Mn, Hg, As and Cd and average poisoning per year are 82 cases.



Table 27 : Number of Patients and Deaths Caused by Hazardous Substance Exposure during 2007 – 2011

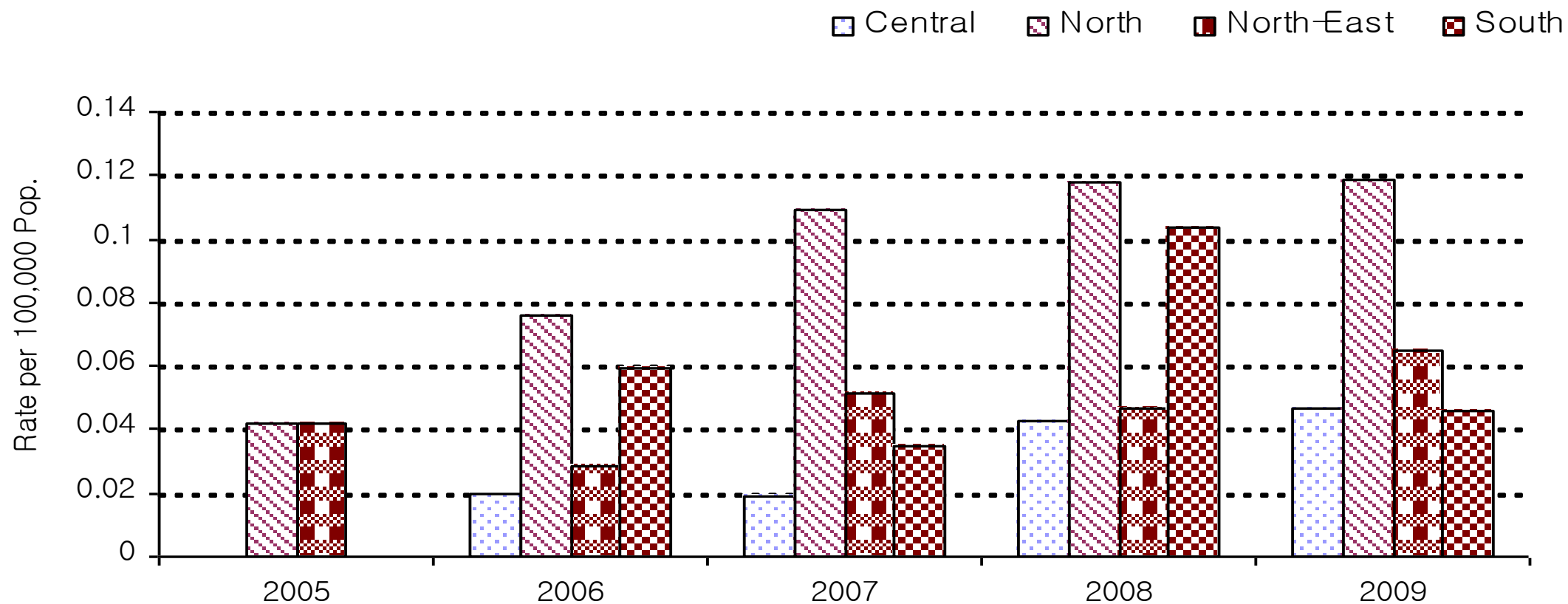
Unit : persons

Hazardous Substance	Year	2007	2008	2009	2010	2011
Agricultural hazardous substances	Patients	1,286	1,642	1,649	2,015	2,011
	Death	-	-	-	-	-
Industrial hazardous substances	Patients	300	226	277	291	239
	Death	1	-	-	-	-
total	Patients	1,586	1,868	1,926	2,306	2,250
	Death	1	-	-	-	-
Percentage increase / decrease	Patients	+9.2	+17.7	+3.1	+19.7	-2.4
	Death	-	-	-	-	-

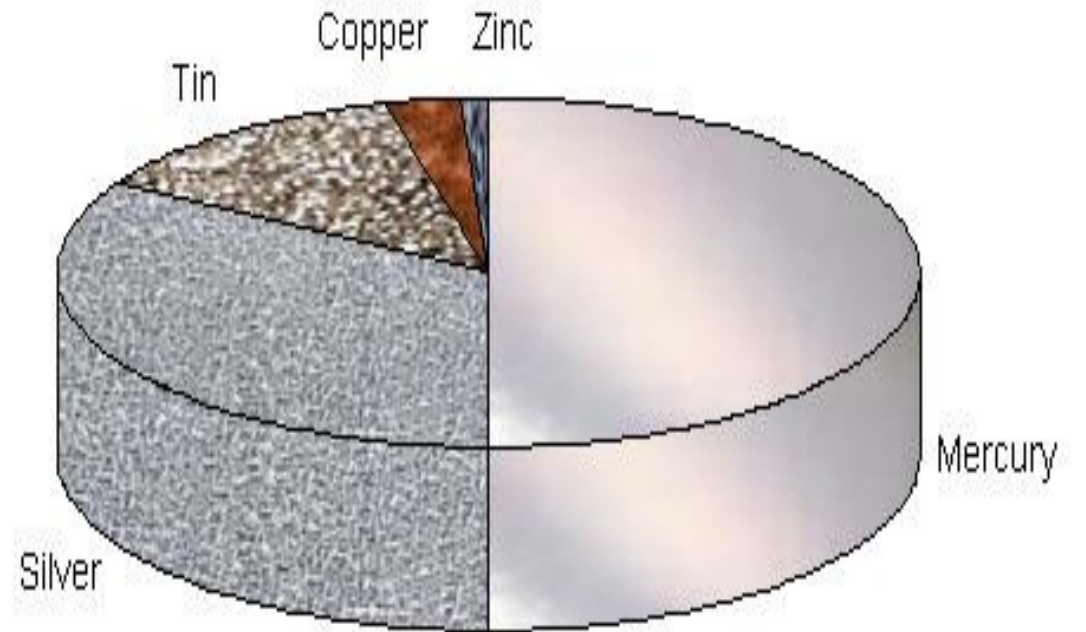
Source : Data from disease surveillance, Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health, 17 February 2012

Statistic of Mn, Hg, and As poisoning in Thailand (Surveillance report)

Fig. 5 Reported Cases of Mn, Hg, As poisoning per 100,000 Population, by Region, Thailand, 2005 - 2009



Dentist exposed to mercury



Determination of Mercury Exposure among Dental Health Workers in Nakhon Si Thammarat Province, Thailand

TABLE 2: Environmental mercury vapor samplings and percentage of mercury airborne levels exceeded (% OELs).

Personal and area samplings	<i>n</i>	Mean	Median	$\mu\text{g}/\text{m}^3$ TWA		Number of mercury airborne levels exceeded (% OELs)
				Min	Max	
Chairs	24	9.42	5.70	0.20	31.10	2 (8.3)
Amalgam storages	17	19.28	18.00	10.00	29.00	6 (35.3)
Preparation areas	17	8.88	10.50	0.70	20.50	2 (11.8)
Total areas samplings	58	8.58	6.40	0.20	29.00	10/58 (17.3)
Personal air samplings	124	15.60	12.20	2.00	38.00	22/124 (17.7)

Determination of Mercury Exposure among Dental Health Workers in Nakhon Si Thammarat Province, Thailand (Con't)

TABLE 3: Urinary mercury levels of exposed and unexposed subjects.

Metal	Exposed (<i>n</i> = 124)	Unexposed (<i>n</i> = 124)	<i>P</i> value
Mercury ($\mu\text{g/g}$ creatinine)			
Mean	8.24	2.00	<0.001*
Standard deviation	1.89	0.11	
Range	2.00–22.84	1.00–10.00	

* Significant at *P* value of <0.05.

Determination of Mercury Exposure among Dental Health Workers in Nakhon Si Thammarat Province, Thailand (Con't)

TABLE 5: Multiple linear regression of dietary habit, occupational life style, PPEs used, and personal hygiene behaviors on urinary mercury levels in dental health personnel.

Parameters	Regression coefficient	SE	<i>P</i> value
Position (dentists, dental hygienist, and dental assistants)	0.0005	0.0002	0.082
Duration of work (more than 5 yrs versus less than 5 yrs)	0.0024	0.0010	0.011*
Mask using (yes versus no)	−0.0477	0.0118	<0.001*
Glove using (yes versus no)	−0.0259	0.0193	<0.001*
Snack eating/water drinking at work (always versus sometimes)	0.1470	0.0294	0.054
Hand washing before lunch (always versus sometimes)	−0.0483	0.0114	<0.001*
Hand washing after work (always versus sometimes)	−0.0479	0.0159	0.0001*
Dietary habit (fish and seafood consumption; ≤3 times/month versus ≥3 times/month)	0.0026	0.0015	0.013*

*Significant at *P* value of <0.05.

Mercury levels in urine and head hair of dental personnel

[Saengsirinavin C](#) , [Pringsulaka P](#)

[The Journal of the Dental Association of Thailand](#) [1988, 38(4):170-179]

- Urine and head hair samples were collected from 201 dental personnel and 57 unexposed controls for mercury analysis
- The mercury content was analyzed by using cold vapor atomic absorption spectrophotometry
- **The results showed that mercury levels in the urine and head hair of dental personnel were significantly higher than in the controls (p less than 0.01)**
- **The amounts of urine mercury from dental assistants, dentists and dental students were 81.0%, 38.2% and 43.5% higher than the threshold limit value respectively.**
- The mean head hair mercury levels found in dental assistants, dentists, dental students and dental technicians were 10.1 +/- 0.84, 7.5 +/- 1.2, 6.5 +/- 1.54 and 2.8 +/- 0.53 micrograms/g respectively
- The mean head hair mercury concentration of unexposed controls ranged from 0.3-12.2 micrograms/g (means = 2.8 +/- 0.36 micrograms/g).



E-Waste



There are more than 100 sites of E waste separator in Thailand

E waste

- E-waste is defined as computer central processing units, monitors, televisions, cell phones and other digital devices.
- The rapidly increasing number of e-waste has the potential to create serious consequences for human health and environmental quality because hazardous chemicals are used in components of electrical and electronic devices that can release into the soil, water supplies, and evaporate into the air when these electronic wastes are placed into landfills or incinerators

Heavy Metal in e waste business in Kokesard , Kalasin Province (Asia Foundation)

Heavy Metal	Heavy metal founded (mg/Kg)	Standard in housing soil (mg/Kg)
Mercury (Hg)	0.70	23
Lead (Pb)	79,520	400
Cadmium (Cd)	1.46	37
Nickle (Ni)	75.2	1,600
Manganese (Mn)	1,519	1,800

Area	Study	Year	Soil	Copper	Lead	Zinc	Cadmium	Nickle	Manga nese	Chromium	Arsenic
Tumbon Koksa-ard Kalasin Province	Penshom et al. (2009)	2008	Waste treatment area	39,161	79,520	-	1.46	75	1,519	-	-
	Suwana mpai (2011)	2010	Waste Buying and separating	-	26,649	-	6.16	619	3,340	-	151
	Environ ment office area 10	2014	Tamboon Waste treatment area	8,671	2,636	11,890	12	118	-	44	9.6
			Waste Buying and separating	9,267	1,388	580	3.3	27	-	18	6.0
Thai Standard				-	400	-	37	1,600	1,800	300	3.9

Study about soil contamination in e waste separating area in Kalasin Province (mg/Kg)



Nielloware workers

Biomonitoring of heavy metals among nielloware workers in Nakhon Si Thammarat Province.

[Decharats S¹](#), [Kongtip P](#), [Phakthongsuk P](#), [Worakhunpiset S](#), [Thetkathuek A](#), [Tharnpoophasiam P](#).

- A cross-sectional study was conducted by interviewing 45 nielloware workers and 45 matched nonexposed persons living in the municipality of Nakhon Si Thammarat Province, Thailand. Blood and urine samples were collected to determine lead and mercury concentrations by atomic absorption spectrophotometer.
- The blood lead levels (7.30 microg/dl) and urinary mercury levels (3.30 microg/g creatinine) of the nielloware workers were significantly higher than the control group ($p < 0.001$).

Biomonitoring of heavy metals among nielloware workers in Nakhon Sri Thammarat Province.

[Decharats S¹](#), [Kongtip P](#), [Phakthongsuk P](#), [Worakhunpiset S](#), [Thetkathuek A](#), [Tharnpoophasiam P](#).

- The nielloware workers developed acute and chronic symptoms, such as headaches, rash, fatigue, tightness in the chest, loss of consciousness, abnormal tiredness and headache at least once a week and those who developed symptoms had significantly higher heavy metal levels than those who did not at $p < 0.05$.



Whitening Cream with Mercury contaminating

- Of the 47 face whitening products sampled from 8 provinces across Thailand, it was found that 1 in 5 of all face whitening creams sampled are contaminated with mercury. The highest level of contamination is 99,070 ppm, while the legal standard for cosmetic products in Thailand is 0ppm of mercury. Moreover, contaminated products contain incomplete labeling according to Thai law. In particular, none of the contaminated products reveal the “notification number” on product labels, meaning that these contaminated products do not exist in the Thai FDA’s database and cannot be traced to the manufacturer should consumers encounter problems from use.

Table 1 Analysis of Mercury Content in Face Whitening Cream

Code	Product Name	Mercury Content (ppm)	Price (baht)	Size	Purchase Location
W41	FC Rice Milk	99,070	40	5 g.	Surat Thani
W37	White Rose	51,600	189	6 g.	Songkhla
W44	Biocollagen	47,960	170	6 g.	Kalasin
W42	Meiyong	41,770	57	5 g.	Songkhla
W39	Best Beauty	34,430	80	5 g.	Samut Prakarn
W40	Pearl Bouncing Face	13,800	20	5 g.	Songkhla
W27	Nature	7,300	300	10 g.	Nonthaburi
W47	Madame	3,435	150	5 g.	Nonthaburi
W32	Babyface	81.14	40	5 g.	Internet
W35	Mahaad Moisturizing Cream	63.53	390	15 g.	Surat Thani
W01	Garnier	<0.05 [*]	179	50 ml	Bangkok
W02	Nivea Day Cream	<0.05 [*]	245	50 ml	Bangkok





INVESTIGATION ON TOXICITY AND HAZARDOUS NATURE OF A MUNICIPAL SOLID WASTE DUMPSITE

by

Romchat Rattanaoudom

A thesis submitted in partial fulfillment of the requirements for the
degree of Master of Engineering
Inter-University Program on Environmental Toxicology, Technology and Management

Municipal treatments used in Thailand

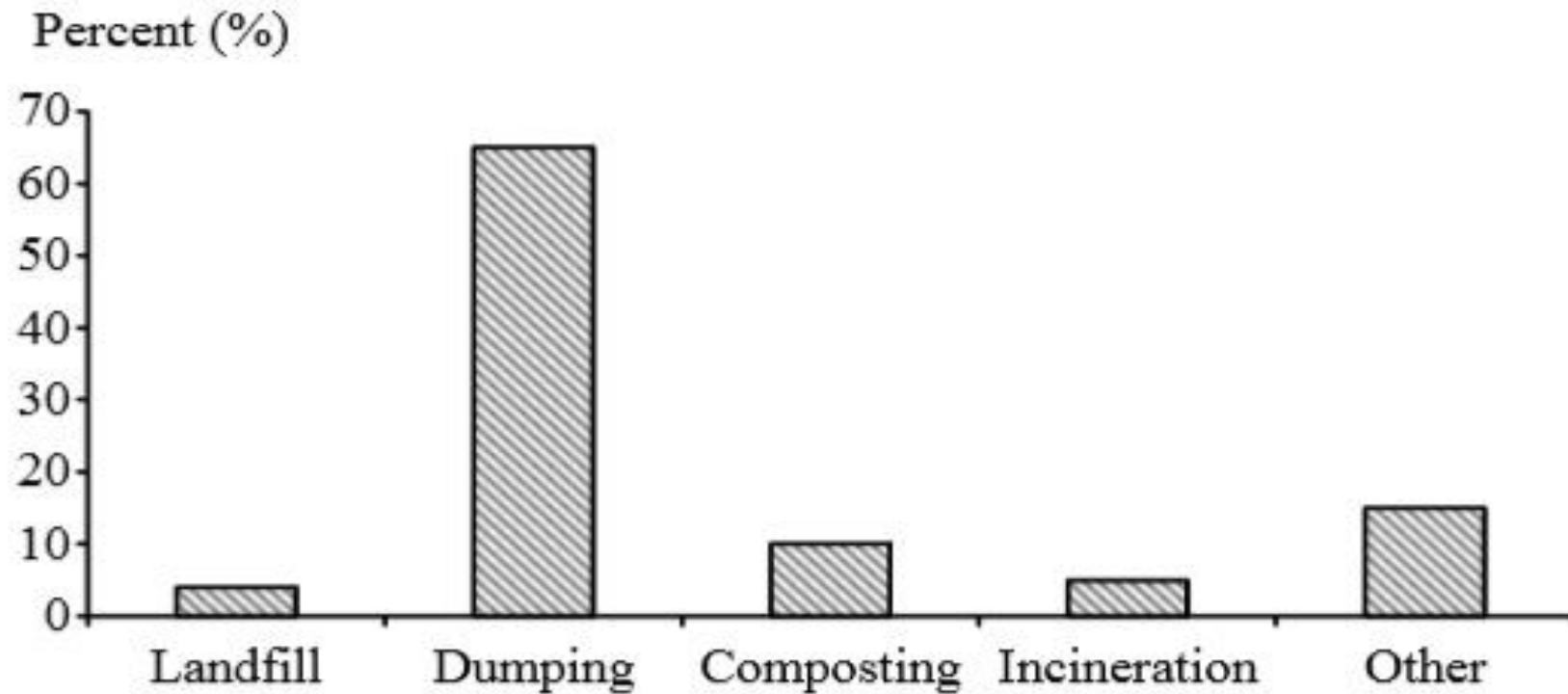


Figure 2.3: Municipal treatments used in Thailand (ARRPET, 2004b)

**Table 4.3: The levels of heavy metal contained in TCLP extract comparing with
TCLP limit (Toxicity Characteristics Leaching Procedure)**

S. No.	S. Code	Hg (ug/L)	Cd (mg/L)	Pb (mg/L)	Cr (mg/L)	Ni (mg/L)	Zn (mg/L)	Cu (mg/L)
1	B 1	7.7	0.6	1.0	1.6	1.9	5.1	1.1
2	B 2	1.8	0.6	0.9	2.6	1.2	5.0	0.6
3	B 3	4.0	0.6	0.8	2.8	1.5	3.2	0.6
4	B 4	4.4	0.2	0.5	3.2	1.3	5.6	0.4
5	A 1	4.7	0.7	BDL	2.0	1.6	4.9	0.3
6	A 2	3.2	0.6	BDL	2.9	1.3	4.1	BDL
7	A 3	3.9	0.7	1.2	3.5	1.5	5.6	1.1
8	A 4	3.7	0.4	1.1	4.0	0.3	6.0	0.4
9	A 5 (4.5m)	-	0.4	BDL	BDL	BDL	1.2	BDL
10	A 6 (4m)	-	0.4	BDL	BDL	BDL	2.7	BDL
11	A 7 (4m)	-	0.4	BDL	BDL	BDL	5.4	BDL
TCLP Regulatory Level ^a		200	1	5	5	20	250	25

^a source: PSS, 2001

Table 4.7: The concentration of heavy metals contained in soil cover samples of dumpsite

Sample Code	Hg (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Cr (mg/kg)	Ni (mg/kg)	Zn (mg/kg)	Cu (mg/kg)
Reference point	0.08	BDL	11.9	BDL	5.25	10	18.5
SC 1	6.8	BDL	261.5	130.7	46.1	289.2	404.1
SC 2	1.6	BDL	15.0	94.2	8.4	49.0	32.4
SC 3	2.5	BDL	23.1	70.7	4.4	112.8	37.9
SC 4	2.9	BDL	BDL	32.6	BDL	64.0	7.9
SC 5	1.2	BDL	4.1	147.6	13.7	28.7	6.6
SC 6	2.6	BDL	182.8	73.8	66.9	278.1	423.0
Germany Std ^a	0.1-1	0.4-1.5	40-100	30-100	15-70	60-200	20-60
France ^a	1	2	100	150	50	300	100
Netherlands Std ^a	0.5	0.5	40	30	15	100	40

BDL means Below Detection Limit

^a source: Compost-Consulting Development, 2004

Mercury Exposure among Garbage Workers in Southern Thailand

Somsiri DECHARAT

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- : A case-control study was conducted by interviewing 60 workers in 5 hazardous-waste-management factories, and 60 matched non-exposed persons living in the same area of Southern Thailand. Urine samples were collected to determine mercury levels by cold-vapor atomic absorption spectrometer mercury analyzer.

Mercury Exposure among Garbage Workers in Southern Thailand

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- The hazardous-waste workers' urinary mercury levels ($10.07 \mu\text{g/g}$ creatinine) were significantly higher than the control group ($1.33 \mu\text{g/g}$ creatinine) ($p < 0.001$).
- Work position, duration of work, personal protective equipment (PPE), and personal hygiene, were significantly associated with urinary mercury level ($p < 0.001$).
- The workers developed acute symptoms - of headaches, nausea, chest tightness, fatigue, and loss of consciousness at least once a week - and those who developed symptoms had significantly higher urinary mercury levels than those who did not, at $p < 0.05$.
- A multiple regression model was constructed. Significant predictors of urinary mercury levels included hours worked per day, days worked per week, duration of work (years), work position, use of PPE (mask, trousers, and gloves), and personal hygiene behavior (ate snacks or drank water at work, washed hands before lunch, and washed hands after work).

Mercury Contamination in Economic Aquatic Species in Songkhla Lake

Sutarat Sukapan¹ Penjai Sompongchaiyakul^{1,*} and Somkiat Khokiattiwong²

- The concentration of mercury in edible tissue of economic aquatic species in Songkhla Lake is not exceed the maximum residue limit as recommended by WHO and Ministry of Public Health of Thailand. Although the mercury level of fishery resources in Songkhla Lake is currently not yet reaching an upper threshold that creates an acute toxicity, accumulation of mercury via food chain may result in a high risk to the consumers.

Environmental Contamination

- Mercury accumulated in Fish and human higher than safety level in Tah-toom Industrial estate Ampor Srimahaphor, Prachinburi Province.
- Analysis of Fish in Klong Chalongwang and hair of residence near Coal-fired power plant and Paper mill, founded that Mercury contaminated in fish 3-11 times higher than safety limit and for those who lived within 2 km. and ate fish had mercury in head hair more than safety level