

Report of the Final Results Workshop for the Project “Management of Mercury and Mercury-Containing Waste”

**Aberdeen University, TESLA, Scotland, U.K.
21 to 23 June 2010**



**UNEP/DTIE
Chemicals Branch
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United Nations Environment Programme (UNEP) Mercury Waste Project Final Results Workshop

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United Nations Environment Programme (UNEP) Mercury Waste Project Final Results Workshop

1 OPENING AND WELCOME

The final results workshop took place at Aberdeen University at Linklater on Regent Walk from 21 to 23 June 2010. This workshop was the concluding activity in the UNEP Chemicals coordinated 5-country project on Mercury Waste Management. The objectives of the workshop were that participating countries, the mercury expert laboratory, the International consultant and UNEP Chemicals to come together to:

- Present the results of the project from each country
- Provide an overview and summary on the analysis and the analytical data that were obtained from the national samples sent to Aberdeen University
- Present the national mercury management plans
- Prepare for the writing of the final project report
- Discuss cross-cutting issues and possible next steps
- Attend a hands-on course on mercury analysis.

On behalf of the University of Aberdeen, the participants were welcomed by Dr. Jörg Feldmann, TESLA. Although invited, the two representatives from Burkina Faso were not able to attend due to internal approval processes for travel, which was not obtained in-time. The participants introduced themselves and their role in this project. The list of participants is included in this report as Annex I. The workshop proceeded as planned; the agenda is attached to this report as Annex II.

Dr. Heidi Fiedler of UNEP Chemicals gave the first technical talk to present the context of this project and the progress made since the inception workshop in March 2009 in Siem Reap, Cambodia. She mentioned the strong linkage of all mercury projects to the negotiation of the legally binding instrument on mercury that has started in June 2010 with the first session of the intergovernmental negotiation committee. She also presented the outline of the final report for this project that will conclude on 30 June 2010.

The presentation can be viewed as Annex 1.

2 COUNTRY PRESENTATIONS

2.1 Cambodia

Mr. Sarun Sambo presented the activities in his country. In June 2009, the National Inception Workshop had gathered information already available in the country and identified priority issues related to waste management for developing a “National action plan and technical guidelines”. Dr. Mario Yarto, the International Consultant attended the workshop. From Sep 2009 to Jan 2010, the national action plan and technical guidelines for Hg Waste management

were developed. The drafts were sent for review to the International Consultant. In Jan 2010, 60 samples were taken from different sites, *e.g.*, ASGM (29 samples; of these 23 were nails and hair, 6 soil/sludge), sludge from public sewage systems, hospitals, dental clinics, dump sites and sent for analysis to Aberdeen University. The Final workshop was held 10-11 June 2010. Hg-Waste Management Action Plan includes the period 2011-2015 and contains five components. Conclusions and recommendation include: Strengthening capacity of officers for effectively implement Hg Waste management instruments, need for demonstration activities.

The presentation can be viewed as Annex 2.

2.2 Chile

CONAMA will become a ministry on 1 August 2010. The general project objective: to identify concentrations of Hg in soil (Andacollo project), study economic feasibility for tailings, develop waste management plan. Methodology: review inventory. Expected outcomes:

Andacollo project: Application of ESM Basel guidelines, assessment and database of laboratory, risk assessment and remediation options in tailings/mines. Specific comments of the SBC guidelines were made. RA of Andocollo – risk assessment and remediation options. Andocollo – hazardous waste regulation does not contain hazardous mining waste; need to revise the national regulation to include the mining waste.

Objective 1: review and revise the mercury inventory. Objective 2: encourage generation and application. Objective 3: promote studies to identify sites with the presence of waste containing mercury, the risk and environmentally sound management.

The presentation can be viewed as Annexes 3a and 3b.

2.3 Pakistan

The project followed the project implementation plan as developed at the international inception WS. A large number of national stakeholders were identified and participated. Site visits were undertaken by the international consultant: Chlor-alkali company wishes to phase out mercury cell and install membrane. National inception WS with 168 participants was held on 30 July 2009 at Lahore. Three working groups met and presented their outcomes. Human hair samples were collected from four groups (22 samples from Ittihad Chemicals Limited; 10 samples from Sittara Chemicals Industries, 22 samples from Punjab dental hospital, 18 samples from control groups) according to the protocol from Aberdeen University and shipped to Aberdeen. In Pakistan the levels were much higher than elsewhere. Further products were collected and are under analysis at national labs such as sun-screens, soaps, button cell and cylindrical batteries; cement – total 61 samples collected.

Draft national mercury waste management plans were developed for chlor-alkali sector, health sector, and light products sector Final national WS was held on 19 May 2010 with 130 participants at Islamabad. Group I chlor-alkali: phase out plan shut down 30 MT of mercury cell within 2 months, remaining 65 MT by 2015; demolition plan for Hg disposal. Group II Health Sector: replacement of mercury amalgam with composite, *etc.* Group III-Light

sources/products.

Future plans and proposal: Phasing out mercury and mercury-containing products in country,

The presentation can be viewed as Annex 4.

2.4 Philippines

Have been the last country to get into contact with UNEP; were not able to collect and send samples. National Action Plan. Sources and flow of mercury and mercury-containing waste. No operating chlor-alkali plant in the Philippines; stock of accumulated mercury exists. In products: batteries, lamps, dental applications, measuring and control devices, chemicals in laboratories; Waste: partly recycled, diffusion to water, soil, air. Toxic waste in landfill, storage, thermal treatment, dumpsites, basically found everywhere. No centralized database or information network on the types and quantities of mercury; data on other uses of crude oil are not considered; data on mercury emissions due to mining of metals are limited to gold, silver, copper, lead; calculation for thermometers needs refinement because the initial calculation was based only on the number of hospitals and schools (have to be phased out by the end of this year by law). Double accounting of Hg emission from pulp and paper sector. Quite a large list of sources of mercury not contained in the inventory (many are folk uses but also limestone quarrying, coal mining, *etc.*). Regulatory framework exist, some orders are already quite old; enforcement harmonization of laws and regulation needs to be undertaken. Not all generators of waste have registered, not all sources of mercury and mercury-containing waste are reported; performance standards on handling, storage and treatment/disposal are generally not followed; interfaced among concerned government agencies. Monitoring program and activities: no monitoring programs on source and applications, wastes are monitored under the clean air act, workplace is regulated by rule 1077; in cement industry is monitoring but not all since not all use waste as alternative fuel. Legally monitored are effluents. Ongoing project on identification of contaminated sites. Major fishing grounds monitored especially bottom feeder fish and seafood. There are no monitoring programs in products and in solid/hazardous waste, ambient air, soil, groundwater, people, biota (only because of incidents, complaints or investigative studies). However, EMB has monitoring in fish.

Summary of workshop: lack of cohesive legal instruments for the management of mercury and mercury-containing waste in the Philippines (lack at local government units), lack of national information on the types and quantities of mercury containing waste. Initial Toolkit did not generate the results on the types and quantitative of Hg; lack of institution controls and infrastructure to manage the end-o-life of products containing Hg. (TSD-treatment, storage, disposal). No program for assessment of levels of Hg in products, lack of monitoring program and releases from mercury and mercury-containing wastes. Lack of monitoring program for releases from Hg-containing waste, no program on... Lack in public participation and IEC-insufficient efforts for public education and awareness. Soil or clean-up standards not yet done but EMB will take the lead on this.

The presentation can be viewed as Annex 5.

3 SUMMARY PRESENTATION OF ANALYTICAL RESULTS

3.1 Mercury analysis and national results

Samples were received from Cambodia, Chile, Pakistan, Philippines. Quality controls such as CRMs, spiked soil and sludge samples were applied. For all samples, total mercury was analyzed.

The presentation can be viewed as Annex 6. Some highlights include the following:

3.1.1 Burkina Faso

Main interest in gold mining. Question: exposed only when working at the gold mine or also when they live close to such mining information. 31 hair samples sent, but mass was limited. Washing followed by oxidative acid digestion. Control group: 1 against 10 was above the WHO limit of 2 mg T-Hg kg⁻¹. About 70% of the hair samples of the AGM miners were above the WHO limit, although the range was quite large; they were significantly different from the control group. The highest was 7 mg T-Hg kg⁻¹.

3.1.2 Pakistan

Pakistan had developed detailed questionnaires that were provided; interesting to note that no marine fish consumed. The hair concentration is up to 20-times higher than anything that has been reported before; highest were close to 10,000 mg T-Hg kg⁻¹. The control group was like in BKF; one was above the WHO limit. In the Dental Group, the people were higher as well as the chlor-alkali plant that phased out Hg five years ago. The results of Kala Shah Kaku chlor-alkali industry was extremely high; the manager has the lowest of this group but was still elevated. Only speciation will give an answer if the Hg came from adsorption or if metabolized through inhalation. In the control group, the dental fillings do not influence the hair concentrations. On the other hand, the dental group had higher concentrations.

3.1.3 Chile

33 soil samples, 42 kg of soil, about 1 kg of milled and very homogeneous soil. Surface samples (assumed that Hg has evaporated); the soil samples were low; highest was 0.9 mg T-Hg. In the center of the dump, the concentrations were highest, the control is what can be expected from uncontaminated soil. The samples were from Andacollo.

3.1.4 Cambodia

Hair and nail samples from ASGM workers and their families (23 samples), soil and sludge samples from different areas (three each). Miners and family members had similar Hg levels; it was said that the family members assist in the profession of the miners. Concentrations in the ore and the sludge at the tailing points are low, the sludge around the tailing points are much higher. The latter one is a bit surprising because Hg is not very mobile.

Comparing the hair and the nail concentrations from the same people, once again there was no difference between family members and workers but there is a larger number of people that have 1 ppm in nail have different concentrations in hair (2-6 mg Hg kg⁻¹), indicating there may be a different exposure. The sludge samples also show the highest concentrations further away; the National Institute of Health. Sludge from the sewer of two hospitals; Calente Hospital much higher than Preah Ang Doung hospital. From the dental clinics had lower concentrations than the clinics. The dental clinics are newer than the hospitals; however, some controversy as to the language and the taking of sludge samples.

3.2 Experiences and lessons learned

The view of the International Consultant (IC) who closely interacted with all countries throughout the project included the following: experiences from the national workshops (country profile, inventory results, priority setting (main sectors/sources), Basel Convention Draft Technical Guidelines ESM of mercury waste, key elements for a national action plan; comments on the national waste management plans.

National workshops were characterized by the following: multi-sectoral participation, public and private sectors, academia, NGOs, other organizations, information sharing, overview of legal framework; presentations from key sectors related to mercury. Mercury emission inventory; use of the UNEP's Toolkit. Requirements to improve the quality of the inventory data, and how applicable for national context; future reviews and updates. SBC guidelines discussions; most discussions on applicability of technical aspects at national context; how important are these when developing national plans.

Two draft action plans were submitted and comments provided (PAK and KHM). Elements are missions and vision, priority setting (discussion of main sectors, main elements); Recommendations: include some background information, set objectives and goals, outline and describe main activities, applicability the SBC TG, requirements and challenges ahead (capacity strengthening, human and financial resources, partnerships, political support to implement the NAP), and monitoring and assessment of the success (set some indicators).

Things to do (for the final report) include:

- Review of NAP
- Comments and suggestions for BC TG (country specific)
- Project's final report (national reports, analytical results)

The presentation can be viewed as Annex 7.

4 LAB WORKSHOP: THEORY AND PRACTICALS OF MERCURY ANALYSIS

The course took place on the second day of the workshop at the Trace Element Speciation Laboratory Aberdeen (TESLA) in the Meston Hall. The workshop participants were welcomed by Dr. Jörg Feldmann and Dr. Eva Krupp. The program included the theoretical and practical aspects of sample preparation and analysis using "high end" state of the art analytical methodologies, as well as field-deployable and affordable methods were discussed and demonstrated. The practical part included a demonstration of trace analysis in a human

hair sample (from Cambodia) with a compact instrument.

Two presentations were given, which are attached as Annex 11 and Annex 12.

5 NATIONAL WASTE MANAGEMENT PLANS

The final day was dedicated to the presentation of the national waste management plans and the preparation of the outline of the final report.

Alejandra Salas presented the plan for Chile. The Plan is part of the Mercury Risk Management Plan and the National Policy for Management of Contaminated Sites. These documents were approved by the Directive Council of CONAMA in August 2009. In Sep 2009, the Coordination Committee was convened. According to the National Mercury Release Inventory; gold mining is the main source of mercury waste; consumer products containing mercury is another issue of concern. It is considered a voluntary initiative promoting extended responsibility of provider (REP) as a regulatory issue...Problems in the development of the plan: Mining Ministry has not priority in addressing management issues related to artisanal gold mining; the private mining sector does not validate the Toolkit as a tool for estimating emissions. Some EFs in the Toolkit are not representative for the Chile situation. Implementing the process: opening WS on 2-3 Nov 2009, meetings of the working group occurred between Dec 2009 and Apr 2010; the closing workshop was on 15 Jun 2010. General objectives and specific objectives were developed.

In the north of Chile there are some natural sources of mercury. Some uncertainties in the issue of updating the Toolkit. Complete the information recorded on mercury in the PRTR and other systems of public record. Improving customs issues of imported or exported waste in order to obtain better information on import and export. Promote studies to identify sites with the presence of waste containing mercury.

Differentiation between natural and anthropogenic mercury: anthropogenic mercury would include the waste from human consumption. Main sectors covered by the plan are mining sector and health sector, lead by Ministry of Health. Harmonize laboratory's analysis at national level. PRTR project includes mercury in the solids and transfer aspect. The plan will be submitted to the Directive Council for approval.

Mr. Zaigham Abbas presented the plan for Pakistan: Waste management plan has eight objectives. In addition, there are national general objectives. The plan includes national environmental standards for water and gaseous emissions. Three priority sectors were identified: 1st is chlor-alkali – Hg as an electrode in industrial processes to produce chlorine and caustic soda. The chlor-alkali sector agreed to comply with this. 2nd is health sector. Main stakeholders including doctors did not know about the toxicity of mercury before this project. Plan contains concrete measures and regulation. 3rd is lighting sector. General conclusions: The plan addresses only measures but does not address recovery from uses.

According to the Pakistan plan, urine should not be used as a biomonitor. Guideline 0.01 mg m⁻³ for air emissions; and 0.01 mg/L for all direct and indirect water emissions. The three sectors in Pakistan are willing to adopt these measures and implement them.

The Action Plan for Cambodia was presented by Mr. Sith Roath. KHM after the civil war has started to integrate the country into the international and regional context; the country

ratified many international conventions, *e.g.*, Basel, Stockholm; Rotterdam Convention not yet ratified. Developed national environmental measurement law. KHM does not have a chemical production industry. MoE is primarily responsible for chemicals issues; for sewage sludge authority is given to the municipality (from end-of-pipe). Sub-decrees are not specifically to chemicals. Priority goals and objectives include the following key components: 1-mercury management in processes operations and products, 2-mercury waste management approaches, 3-Research, monitoring, modeling, assessment and inventories, 4-communication activities, 5-implementation and compliance. Proposed action plan for 2011-2015 specifies the five components above and also includes the analytical testing. Requirements to achieve the goal for the 5-year action plan 2011-2015: Financial requirement for 5-year plan 2,935,000 USD, cooperative partners, development partners such as UNEP, UNDP, UNITAR, UNIDO, GEF, governments and countries' Trust fund, banks such as WB, ADB, and others. Towards the end, review of this plan and development of next action plan. In 3rd quarter the plan may be approved and then concept notes can be developed. Most environmental action plans in Cambodia are a road-map. To be presented to donor meetings; government to provide 20% as in-kind.

The presentations are attached to this report as Annexes 8 (KHM), 9 (CHL), and 10 (PAK).

The **Philippines** had included the national action plan in their comprehensive presentation on the first day of the workshop. For reference, please consult Annex 5.

6 PREPARATION OF FINAL PROJECT REPORTS, CONCLUSIONS, RECOMMENDATIONS

Ms. Heidi Fiedler informed and reminded that the final products of the projects include a technical report and final financial statements. She provided a template for the financial statement and presented the draft outline of the final project report and distributed the template. The table of content is shown below.

In order to facilitate the compilation of information and harmonize the appearance of the national summaries, the International Consultant offered to prepare some guidance headings for use by the participating countries. The offer was welcome. The five items are as follows:

Component 1. Review of quantitative and qualitative data from the national inventory of mercury sources

Component 2. Prioritization of mercury sources and the corresponding sectors:

Component 3. Development of a national mercury waste management plan:

Component 4. ESM application in selected sources and sectors:

Component 5. Sampling and mercury analysis of environmental and human samples.

Discussions also included the benefit of publishing results of the project in the open scientific literature. Dr. Feldmann offered to lead publications addressing the analytical results in an international context; he will contact countries to obtain more information on the samples and offered to undertake some speciation analysis to further facilitate interpretation of the results. Dr. Mario Yarto offered to prepare a draft publication on the political dimension of the project

in relation to other MEAs (Multi-lateral Environmental Agreements).

Mercury Waste Management Project

Final Report

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7 CLOSURE OF WORKSHOP

After exchange of the usual expressions of courtesy and thanks, the workshop was closed at 15:00 hours on Wednesday, 23 June 2010.

8 ANNEX I: LIST OF PARTICIPANTS

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9 ANNEX II: PROGRAMME



United Nations Environment Programme (UNEP) Mercury Waste Project Final Workshop

Programme

Monday 21st June 2010

09.00 – 09.10	Taxi - 3 x 6 seater taxi's booked in the name of Feldmann, Jury's Inn to Linklater on Regent Walk	
09.00 – 09.30	Registration and Coffee	Linklater Rooms
09.30 – 10.00	Welcome	
10.00 – 12.30	Country presentations (20 min each & 10 min discussion)	
12.30 – 13.30	Lunch	
13.30 – 17.30	Summary presentation of: - Mercury analysis and national results - Experiences and lessons learned; view of international consultant	
17.30 – 17.40	Taxi – 3 x 6 seater taxi's booked in the name of Feldmann, Linklater on Regent Walk to the Jury's Inn	
19.30	Dinner	The Square restaurant

Tuesday 22nd June 2010

08.30 – 08.40	Taxi – 3 x 6 seater taxi's booked in the name of Feldmann , Jury's Inn to Meston on Elphinstone Walk	
09.00 – 12.30	Lab Workshop: Theory and practicals of mercury analysis	Meston
12.30	Collect packed lunch	
12.30 – 13.15	Bus to Fettercairn Distillery	
13.15 – 14.30	Fettercairn Distillery tour	Fettercairn Distillery
14.30 – 15.00	Bus to Crathes Castle	
15.00 – 17.15	Crathes Castle Visit	Crathes Castle
17.15 – 18.00	Bus to the Tolbooth Restaurant	
18.00 – 20.00	Dinner	Tolbooth Restaurant, Stonehaven
20.00 – 20.30	Bus to the Jury's Inn	

Wednesday 23rd June 2010

08.30 – 08.40	Taxi – 3 x 6 seater taxi's booked in the name of Feldmann , Jury's Inn to Linklater on Regent Walk	
09.00 – 12.30	National waste management plans	Linklater
12.30 – 13.30	Lunch	
13.30 – 17.00	Preparation of final project reports, conclusions, recommendations Closure of workshop	Linklater
17.00 – 17.10	taxi – 3 x 6 seater taxi's booked in the name of Feldmann, Linklater on Regent Walk to Jury's Inn	

Travel times are an estimate