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Global Mercury Project

Project EG/GLO/01/G34: Removal of Barriers to Introduction of Cleaner Artisanal Gold Mining and Extraction Technologies

GEF UNDP UNIDO

From the Editor

In this issue we highlight the results from the environmental and health assessments conducted in mercury-affected hotspots in Brazil, Indonesia and Tanzania as well as the follow-up activities for the dissemination of results and training of local health authorities. Additionally we will report on training activities for laboratory technicians in applying state of the art methods in monitoring mercury pollution.

Results of Environment and Health Assessment in Tanzania

The environmental assessment demonstrated that although the heavy mineral tailings are highly contaminated with mercury, dispersion of this material into the streams and onto agricultural soils appears to be quite restricted. Generally low concentrations of mercury occurred in most of the analyzed soils used for cassava, maize, and rice cultivation. Higher mercury in urban soils is probably caused by air borne transport and deposition of mercury released during the burning of amalgam. Although mercury is high in some vegetable plot soils, mercury in vegetable, rice and maize samples collected from the agricultural areas impacted by mercury contamination is generally low. Fish are highly sensitive bioindicators of mercury contamination so it is not surprising that mercury in fish collected from contaminated ponds close to Rwamagasa exceed the WHO recommended standard for the protection of health of vulnerable groups. The impact of mercury contamination on fish in the lower reaches of the Malagarasi River and the international waters of Lake Tanganyika, located about 400 km downstream of Rwamagasa, is not readily discernible, probably because dispersion of mercury is inhibited by the extensive swamps located between Rwamagasa and Lake Tanganyika.

Exposure estimates indicated that the local people should not be exposed to dangerous levels of mercury if they continue to eat fish from Lake Victoria and locally grown crops. However, consumption of fish caught in highly contaminated ponds in the immediate vicinity of the mineral processing centres should be avoided.

The health status of 211 volunteers in the Rwamagasa artisanal gold mining area and 41 non-exposed people from a nearby control area was assessed using state of the art in clinical, neurological, neuro-psychological and toxicological l tests by a team of experts from the Institute of Forensic Medicine, Ludwig-Maximilians University, Munich. Mercury concentrations in the bio-monitors urine, blood and hair were significantly higher in the exposed population from Rwamagasa compared with the control group, and amalgam burners showed mercury levels above the toxicological threshold limit in urine, blood and hair. Mercury intoxication was diagnosed in 25% of the amalgam burners from Rwamagasa. In addition, intoxication was also detected in people that had formerly worked with mercury and amalgam. Inorganic mercury from mercury vapour, rather than organic mercury from fish or agricultural crops, contributes to the high body burden of the artisanal miners. Extremely high mercury concentrations were detected in two out of five breast-milk samples from nursing mothers who worked as amalgam burners. This is an important discovery because mercury can cause severe damage to the developing brain. The exposure of the whole community to mercury is reflected in raised mercury levels in the urine, and the detection of the first symptoms of brain damage such as loss of coordination, tremor and movement disorders. People from Rwamagasa who are not directly involved in amalgam burning have a higher mercury burden than the control group, although the majority of these people are not intoxicated. The mercury burden in the control group is the same order of magnitude as in western industrial countries. Recommendations were made by UNIDO regarding the reduction of mercury as an environmental and health hazard.

After the CTFM, an awareness raising campaign for local health authorities was started in the field (Geita area) by a team of local and foreign experts. About 19 health care providers from various mining areas in Geita district received training on awareness for mercury as a health hazard from 20th to 24th October 2004. The four-day intensive training covered various topics, including mercury as a health hazard, medical treatment and solutions to reduce mercury exposure. Symptoms of a chronic mercury poisoning as well as health problems related to environmental, water and sanitation, were equally covered during the training.

The Global Mercury Project (GMP) *began in August 2002. The GMP will demonstrate ways of overcoming barriers to the adoption of best practices and pollution prevention measures that limit the mercury (Hg) contamination of international waters from artisanal and small-scale gold mining (ASM). Six countries are participating in the GMP: Brazil, Lao PDR, Indonesia, Sudan, Tanzania and Zimbabwe. In addition, the GMP aims to introduce cleaner technologies, train miners, develop regulatory mechanisms and capacities within Government, conduct environmental and health assessments (E&HA) and build capacity in local laboratories to continue monitoring Hg pollution after the project.*

Cooperation of GMP with National Institute for Minamata Disease (NIMD)

The mission of CTA in May followed an official invitation of the Institute and was undertaken at no costs for the Project. Dr Eto, Director-General of NIMD, offered to assist the Project with methyl mercury analyses in hair. That would enable the Project of making a follow-up on people in hotspots, who had been identified as intoxicated. Some hundreds of samples will be analysed free of charge. Additionally, GMP and NIMD will join efforts in a worldwide awareness campaign on mercury emissions from small-scale gold mining. As a first step, the production of a video is envisaged to inform on the emerging type of mercury pollution in developing countries. The film will encourage Governments to accept assistance in overcoming barriers to the introduction of cleaner technologies in small-scale gold mining including monitoring. NIMD will apply for US$ 300,000 from the Government of Japan for the production of this video and the dissemination of the film to high-ranking government officials visiting Japan.

Training of laboratory technicians in USA and Brazil

The training took place in Research Triangle Park/ North Carolina and Rio de Janeiro. Participants were introduced into the objectives of the GMP environmental and health monitoring program and trained in using LUMEX RA-915 for environmental monitoring of Hg pollution. The course was based on principles of atomic adsorption and hands-on demonstration/application, operating the equipment and analyzing samples. Training included analysis of Hg in air, water, soil and biological material (fish). After each chapter, participants had to undergo tests for checking the understanding and required skills in calibrating/operating the equipment.

Additionally, participants were trained in CETEM's method developed for analyzing mercury at a semi-quantitative level in fish, urine, and inorganic samples. For checking the understanding of participants and to ensure their active participation, the same type of training as in RTP was applied. Practical exercises were carried out for determining Hg in fish, urine, soil, sediments and mining residues.

Training in CETEM, Rio de Janeiro, Brazil

7th International Conference on Mercury as a Global Pollutant Ljubljana, Slovenia 27 June - 2 July 2004

The purpose of the Conference was to promote sound management of mercury at local, regional and global level and to enhance an interactive process between science, policy-making and society in order to develop effective strategies and solutions for addressing the adverse effect of mercury. The scientific program consisted of short courses, oral and poster presentations and roundtables. The results of Global Mercury Project were presented in more than 15 publications.

Results of Environment and Health Assessment in Brazil

The environmental and health assessment (E&HA), in Brazil, was conducted by the Centre for Mineral Technology (CETEM) in collaboration with Evandro Chagas Institute (IEC), under the general coordination of United Nations Industrial Development Organization (UNIDO) and was performed in two small scale gold mining areas in the Brazilian Amazon: São Chico and Creporizinho villages, belonging to Itaituba Municipality. The results were presented in the 3th Task Force Meeting in Manaus, hold in April 26-27th and in Itaituba April, 28-29th.

The health assessment part of the Global Mercury Project was designed to complement the environmental assessment, providing indications of the level of mercury poisoning and their health effects on Small-Scale Gold Mining communities either by exposure to mercury vapors, by ingestion of contaminated food, in particular fish as the most accessible protein in riparian and communities, or both. Based on assessment of the pathways and bioavailability of mercury vapor and methylmercury to the mining communities, the heath assessment combined information from biological samples associated with medical exams to evaluate the level of impact that the pollutant caused or may cause to individuals residing in "mining and environmental hot-spots".

The results of the E&H Assessment in two gold mining areas in Brazil showed high mercury levels all over the nearby water body close to São Chico village, including sediments (averaging 4.10 µg/g) and aquatic organisms (averaging 4.97 µg/g in fish), which showed Hg levels much higher than the WHO recommended limit of 0.5µg/g in fish. According to the present results, São Chico has shown clear indications of Hg dispersion from mining hotspots, reaching a distance at least as long as 20 km. This presents of a major environmental and health concern. The environmental factors responsible for this particular Hg behavior, marked by its high mobility, are likely to be linked to both the cyanidation attempt and pasture fires. Most of the fish from São Chico showed higher mercury levels than fish from Creporizinho area. Additionally, in São Chico area the highest levels of mercury bioaccumulation in fish were found in Traira species, a carnivorous and appreciated

species for consumption by local residents, extending the environmental risk to a health issue. In addition, Hg concentrations are much higher in aboveground parts of vegetable produces at São Chico study area than in Creporizinho and this makes the vegetables produced in backyards of the village, a further potential pathway of Hg exposure to the population, besides fish consumption and inhalation of Hg vapour.

Environmental sampling in Tapajos

The general health conditions observed in both areas revealed to be very precarious, as demonstrated by extremely high incidence of malaria, parasithosis and other diseases not related to mercury exposure. Since mercury burning in open air is a common practice in both areas since at least 1989, one could realize that chronic exposure to inorganic mercury is widespread. Moreover, pasture fires over Hg contaminated soils in São Chico characterizes a further exposure route to inorganic mercury for local population.

Hg levels in hair samples are relatively low, 75% of both populations presented Hg concentrations lower than 4 µg/g, lesser than the biological exposure index (BEI, 10µg/g). However, the mean Hg concentration in hair samples from São Chico are the double of those from Creporizinho and there are some individuals with Hg levels in hair above the BEI. They could be considered as a critical group for monitoring.

With regard to Hg in urine, the higher exposure to inorganic mercury in São Chico is reflected by 20.2% of the gold miners with Hg levels in urine between 10 and 50 µg/g creatinine, considered as a biological limit, while in Creporinho only 13% fall in this range. Moreover, 2.9% of the gold miners in São Chico and 1.2% in Creporizinho present Hg levels higher than 50 µg/g creatinine. This is an indication that the gold miners in São Chico are more intensively exposed not only to methylmercury, but also to inorganic mercury, in relation to Creporizinho.

Within the control group, represented by the population not directly involved in gold mining activities, it is observed that 13.9% of the population in São Chico present Hg levels in urine higher than 10 µg/g creatinine, while in Creporizinho only 0.6% falls in this range. With regard to Hg levels higher than 50 µg/g creatinine in this group, only 1.5% of the population

In São Chico falls in this range, whereas no individual in Creporizinho does.

Health examinations in Tapajos

In relation to symptoms potentially associated with mercury exposure, the significant incidence of metallic taste, paresthesia, tremors and palpitation in humans from both areas should be high-lighted. As for paresthesia, an incidence in the gold miners group as high as 30% in São Chico and 50% in Creporizinho has been observed, while within the control group in both areas this incidence decreases to 1.5% and 0.5% respectively. These results strengthen the need for a continuous monitoring on the health effects within the identified critical groups. In addition to the critical groups identified by Hg levels in biological samples, there are individuals with neurological symptoms even if the Hg levels are lower than in the critical groups.

Training of local people to perform fast Hg tests in fish

Activities April – October 2004

- ✓ Country Task Force Meeting and Workshop on Communication of Environmental and Health Situation in Selected Gold Mining Hotspots in the Tapajós Area, 26 - 29 April 2004
- ✓ Regional Awareness-Raising Workshop on Mercury Pollution, 26-29 April 2004 in Bangkok, convened by UNEP-Chemicals.
- ✓ Tanzania Women Miners Association Conference in Morogoro, 4-8 May 2004.
- ✓ International Workshop on Harmonization of Mercury Measurements Methods and Models to Assess Source-Receptor Impact on Air Quality and Human Health, 23-26 May, 2004, Maratea, Italy
- ✓ 7th International Congress on Mercury as Global Pollutant, Ljubljana, Slovenia, 27, June-2 July 2004
- ✓ Workshop on "Small Scale Mining Is Here To Stay", 22nd - 23rd July 2004, Mine-Entra Exhibition Centre, Bulawayo, Zimbabwe
- ✓ Training of laboratory technicians in using LUMEX analyzer at US EPA in Research Triangle Park/ North Carolina, 19-22 July 2004
- ✓ Training of laboratory technicians in semi-quantitative mercury analysis at CETEM, Rio de Janeiro, 26-28 July 2004
- ✓ Presentation of GMP to Ministry of Industry, Mines and Energy of Cambodia, Phnom Penh, August 2004
- ✓ Discussion of TOR for demonstration unit with Department of Geology and Mines of Lao PDR, Vientiane, August 2004
- ✓ Preparation of Country Task Force Meeting Indonesia and discussion of TOR for demonstration unit, August 2004
- ✓ Regional Awareness Raising Workshop on Mercury Pollution, Buenos Aires, 13-16 September 2004
- ✓ Country Task Force Meeting on Communication of Environmental and Health Situation in small-scale gold mining hotspots in the Geita District, Lake Victoria Area, Dar es Salaam, Tanzania, 18 October 2004
- ✓ Training of local health authorities in Geita District, Tanzania, October 2004
- ✓ Consultations with equipment manufactures in Johannesburg, RSA, October 2004

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Plans for November 2004 – March 2005

- Regional Awareness Raising Workshop on Mercury Pollution, Dakar, Senegal, November 2004
- Country Task Force Meeting Indonesia for presentation of the environmental and health assessment, November 2004
- Awareness raising campaign for local health authorities in Sulawesi, Indonesia
- Discussion of TOR and institutional arrangements for demonstration unit with Department of Geology and Mines, Lao PDR, Vientiane, November 2004
- Production of a video on worldwide GMP activities
- Initiation of second international bidding for demonstration equipment to be used in the 3 African countries
- Regional Awareness Raising Workshop on Mercury Pollution, Tobago and Trinidad, January 2004
- Country Task Force Meeting Lao PDR for presentation of the environmental and health assessment, 1st quarter 2005 followed by training of local health authorities in Luang Prabang
- Country Task Force Meeting Zimbabwe for presentation of the environmental and health assessment followed by training of local health authorities in Kadoma area, 1st quarter 2005
- Preparation of workshop on improvement of legal framework of the small-scale gold mining sector for 3 African countries
- Finalization of Training Modules for officials, equiment manufacturers, miners.

Training of lab technicians at US EPA in RTP North Carolina

Training of lab technicians in using LUMEX