



**UNIDO Technical Guidelines on
Mercury Management in
Artisanal and Small-Scale Gold Mining**

April 2008

I. PURPOSE

In the absence of an international management code for mercury management in artisanal and small scale gold mining (ASM), many governments have been unsure how to address policy in ASM.

The *U.N.I.D.O. International Guidelines on Mercury Management in Artisanal and Small-Scale Gold Mining* are proposed for the purpose of assisting governments in the development of policy, legislation and regulation that will lead to improved practices of artisanal and small-scale gold mining (ASM).

These guidelines apply to all legal mining areas, gold shops, and mineral processing operations where mercury is used for gold amalgamation. The guidelines provide minimum standards which can lead to the future elimination of mercury use in ASM operations. In all cases possible, miners should be encouraged to adopt appropriate mercury-free mineral processing methods.

The central aim of these guidelines is to assist governments in the development of legislation and/or regulation to accomplish the following goals:

- (1) reduce ASM-related mercury emissions into the environment;
- (2) reduce occupational and second-hand exposure to mercury;
- (3) eliminate the major inefficient and unsafe practices of mercury use; and
- (4) reduce unsafe storage and disposal of mercury.

II. BACKGROUND

These measures are formulated based on health, environmental, technical, socioeconomic and legal assessments that were undertaken by the Global Mercury Project. This project was initiated with the support of the Governments of Zimbabwe, Tanzania, Sudan, Indonesia, Brazil and Laos, with the United Nations Industrial Development Organization (UNIDO), the Global Environmental Facility (GEF) and the United Nations Development Program (UNDP).

In more than 50 developing countries across Asia, Africa and South America, an estimated 15 million people are involved in artisanal and small scale gold mining (ASM). This activity usually involves the use of substantial amounts of mercury in mineral processing, often in highly unsafe and environmentally hazardous conditions. As many as 100 million people may be affected, directly and indirectly, by mercury emitted from ASM. Mercury is a neurotoxin that bioaccumulates through the food chain, and mercury misuse in ASM is responsible for an estimated 1,000 tonnes of mercury discharged annually into the environment, with negative impacts in diverse ecosystems including international waters. Globally, many of the hazards are similar – extensive emissions in tailings, contamination of water bodies, vapor inhalation, etc. However, environmental regulations are minimally developed for ASM in most countries or not yet developed, and consequently, mercury is generally unaddressed.

III. IMPLEMENTATION

Governments should identify the appropriate authority responsible for implementation of these guidelines, and make any appropriate modifications to the technical measures to include in developing new mercury laws, policies or regulations. It is recommended that such policies be adopted under the clear jurisdiction of authorities that are responsible for small-scale mining

issues, in consultation with other relevant authorities, recognizing that such authorities may be best suited to conduct monitoring.

Strong emphasis should be placed on encouraging local-level governance and community based monitoring systems. Community stakeholder participation in the processes of policy development and field implementation are critically important.

Governments should provide ways to legalize the artisanal and small-scale miners as well as to educate them on environmental management. Technological assistance and capacity/education services should be provided in all areas where there is a high concentration of small-scale miners.

These guidelines apply to all legal operations where mercury is used to amalgamate gold, amalgam is being burned or retorted, and gold is being melted. These guidelines provide minimum threshold standards that significantly reduce mercury emission and exposure where properly implemented. However, in all cases possible, miners should be encouraged to adopt appropriate mercury-free mineral processing methods.

IV. PRINCIPAL TECHNICAL MEASURES

1. RESPONSIBILITY OF EMPLOYERS OF MINING/PROCESSING PLANTS / GOLDSHOPS OPERATION

In all cases, the primary mining/ore processing license holder and gold shop owners should be held legally responsible for safe practices, including those involving mercury. The mining license holder or gold shop owner should institute reasonable safety measures to prevent the exposure of employees or other persons to mercury fumes.

2. LICENSE TO WORK WITH MERCURY

All licensed operations where mercury is used or handled should obtain a special license specifically for mercury at its facility. When miners apply for mining licenses and before beginning operations, miners should demonstrate awareness of how to comply with these guidelines.

3. NO WHOLE ORE MERCURY AMALGAMATION

No person should amalgamate the entire ore, through the use of a mercury-copper plate or using mercury directly into any gravity concentrator, centrifuge, or ball mill, Chilean mill or stamp mill. This causes mercury flouing which reduces recovery and induce that a large portion of mercury is lost to the environment with tailings. Amalgamation must be used **ONLY** for gravity concentrates.

4. MERCURY AMALGAM BURNING

No person should heat/burn mercury amalgam to recover the gold without using a retort. Retorts contain and condense the mercury vapour releases and should be used to recycle mercury (in the form of a bowl retort, pipe retort, hood, etc).

Amalgamation burning must not take place in domestic residences. This must be done distant (say **MORE THAN 500m**) from any house. No children and pregnant women must be present during the retorting activities.

5. NO MERCURY-CYANIDE INTERACTION

No person should use mercury in conjunction with cyanide, or conduct cyanidation of mercury rich tailings as this practice increases mercury methylation.

6. AMALGAM BARREL

Amalgamation of concentrates must NOT be conducted manually. This must be conducted in small plastic or steel rotating barrels with rubber balls or a chain inside to increase the homogenization of the mixture of concentrate and mercury. Amalgamation time should be kept as short as possible. Amalgamation should be controlled and stopped, if no visible free gold can be seen. The amount of mercury added into the barrels must be gradual, until all free gold is caught. No cyanide or potassium permanganate or any other oxidizing agent must be allowed to be added to the barrel; only a dash of detergent is enough to clean gold particle surfaces. An amalgam separator such as an elutriator must be promoted to separate amalgam from heavy minerals after amalgamation. A carpet sluice placed after the elutriator will ensure that the fine mercury is captured.

7. CENTRALIZED AMALGAMATION SITES

Amalgamation and retorting should only be conducted in designated sites (amalgamation pools and isolated retorting places) distant at least 500 m from any inhabited place. For any mining location where amalgamation occurs, the primary license holder or mine manager shall designate a portion of the mining location as the prescribed structure, facility or locale where amalgamation may take place. Amalgamation may only take place in such structure, facility or locale. The holder of an ASM license shall ensure that washing or settling ponds are constructed in his or her license area to provide for washing and sluicing, and no such washing and sluicing shall be done along or close to rivers, streams or any other water sources.

8. PROTECTION OF WATER BODIES

No person should conduct amalgamation or separation of amalgam from concentrates or burning amalgam or retorting in any natural water body or within a distance of 100 metres from any natural water body, including rivers, streams, lakes, and other water bodies.

Amalgamation tailings must not be discharged into a water body or in places susceptible to flooding.

9. PROTECTION OF RESIDENTIAL AREAS

No person should use mercury for amalgamation or any other purposes in residential areas or within a distance of 100 metres from any residential areas, including villages, towns, cities, or settlement areas.

10. DISPOSAL OF MERCURY OR MERCURY-CONTAMINATED TAILINGS

Any disposal of mercury-contaminated tailings should be done in a safe and proper way. No person should discharge mercury-contaminated tailings into a water body or in places susceptible

to flooding. Disposal of mercury-contaminated tailings must be done by placing it on a clay or laterite soil-lined pit of several metres depth, located 100 metres away from any water body. When the hole is filled with mercury-contaminated tailings, this must be covered with 1 meter of clay or laterite, then compacted, covered with soil, and re-vegetated.

11. EXTRACTING RESIDUAL GOLD FROM MERCURY-CONTAMINATED TAILINGS

Mercury-contaminated tailings must not be recycled to the concentration circuit once this contaminates the primary tailings. If any process is to be applied to recover residual gold from mercury-contaminated tailings such as leaching with cyanide, thiourea, etc., the residual mercury must be removed (e.g. by gravity concentration) prior to leaching. The effluents and tailings from gold extraction must still be treated as mercury-contaminated tailings and must be buried.

12. CONDENSERS FOR GOLD SHOPS

Any shop buying retorted gold, or any shop that is retorting gold, must have a proper fume hood installed to capture, condense and recycle mercury. The design of the fume hood should be such that over 90% of the mercury is captured.

13. STORAGE OF MERCURY

Metallic mercury should be stored safely at all times when not used; in (a) a secure location that is inaccessible to children; and (b) unbreakable air-tight containers that are covered with a thin layer of water (e.g. 1 centimetre) to prevent mercury evaporation. Mercury should NOT be stored in a domestic residence.

14. PROTECTION OF PREGNANT WOMEN AND CHILDREN

People who perform amalgamation, retorting, melting gold or handling mercury must ensure that no pregnant women, or children under the age of sixteen, enter the structure, facility or locale in which mercury is being used.

15. MERCURY-FREE METHODS

The above guidelines demonstrate minimum *threshold requirements*. These measures significantly reduce mercury emission and exposure where properly implemented. However, in all cases possible, miners should be encouraged to adopt appropriate mercury-free mineral processing methods. For small amounts of concentrate, the blowing-tapping method should be promoted.