



Using retorts to
reduce mercury
exposure in artisanal
and small-scale gold
mining

A PRACTICAL GUIDE



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Using Retorts to Reduce Mercury Exposure in Artisanal and Small-Scale Gold Mining

A practical guide



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Who is this document for?

This document has been designed to help guide the training of Artisanal and Small-Scale Gold (ASGM) miners on retort use and mercury exposure reduction. Although this guide is not meant as an exhaustive document on all retort types and their adequate uses, it represents general guidance and recommendations for individuals and groups contemplating a retort distribution program.



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Mercury in hard-rock artisanal & small-scale gold mining



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- a.** Rocks with gold (ore) are taken from the ground



- b.** Ore is crushed to free gold particles



- c.** Mercury is added to the ore to grab the gold particles



- d.** The ball of amalgam is made of mercury and gold



- e.** The amalgam is burned to evaporate the mercury



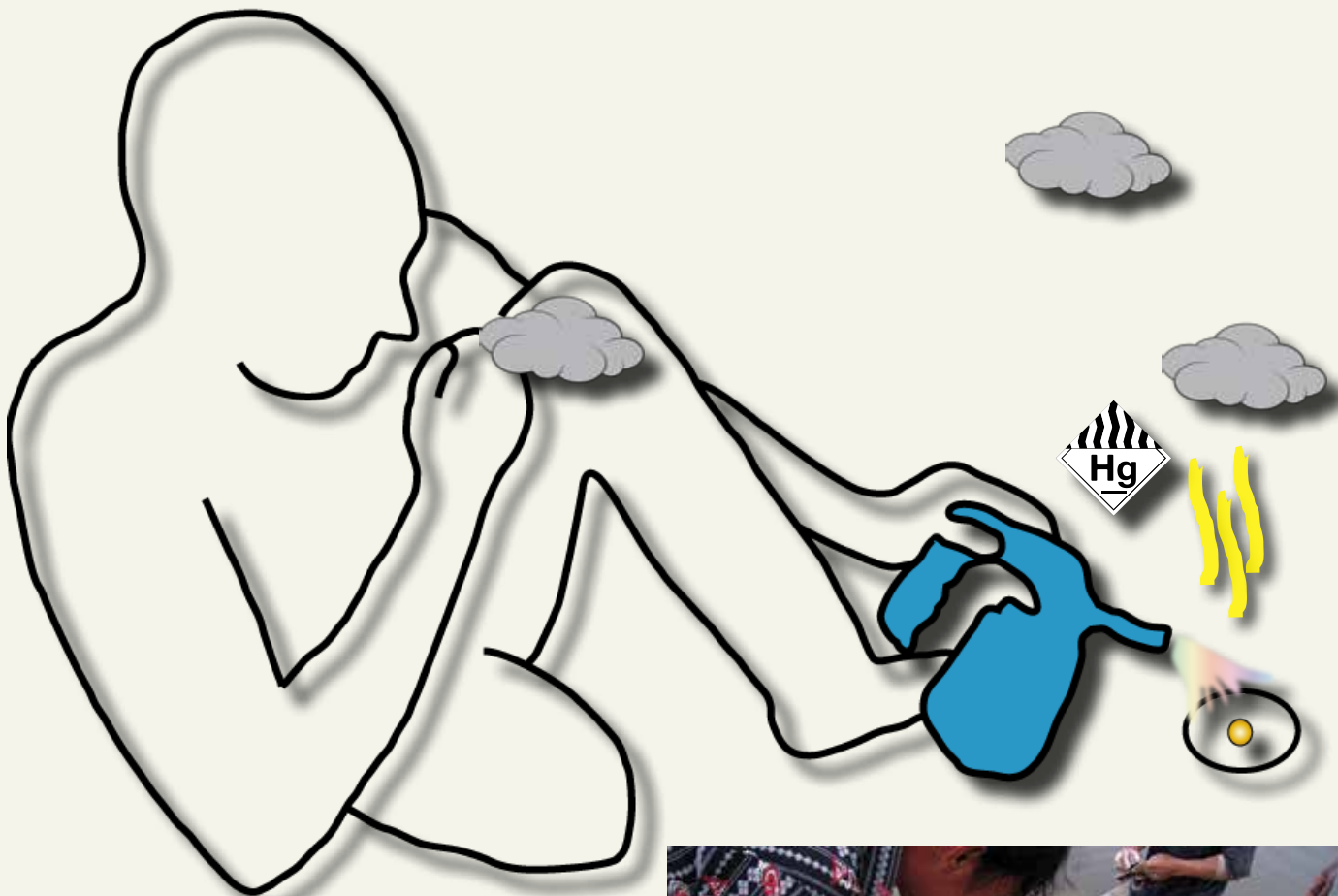
- f.** Sponge gold (porous) is left behind

How can people be exposed to mercury in ASGM?



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1) The miner or trader may first touch the mercury or amalgam with bare hands. He then burns the amalgam in open air and breathes in the mercury vapors. The vapors can't be seen.



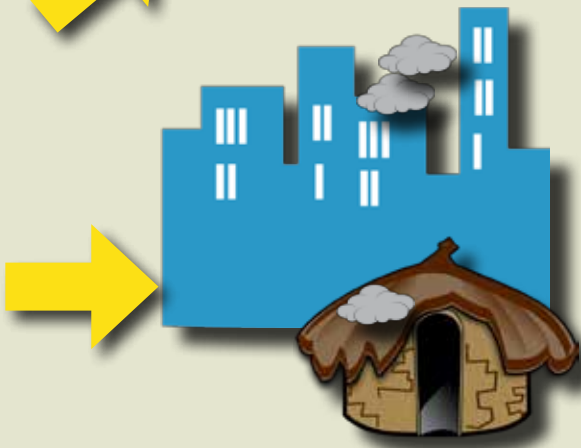
How can people be exposed to mercury in ASGM?



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2) This vapor goes into the air and sticks onto the walls (for example inside the hut), clothes and other objects near the amalgam.



3) The vapors that deposit on surfaces are later released into the air. **4)** The vapors spread through the community with the wind.



5) People in the village get exposed by breathing in the vapors when they enter a place where amalgam was burned, even a long time after the burning took place. Also, contaminated clothes and other objects that workers bring home can expose their families and friends to mercury.



6) Sometimes, when mercury enters rivers and lakes, it can be taken up by fish. When people eat the contaminated fish or seafood, the mercury enters their body.

Effects of mercury



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Mercury affects mainly the brain and the nerves. It can also affect the kidneys and the heart. People exposed to mercury can experience the following symptoms:

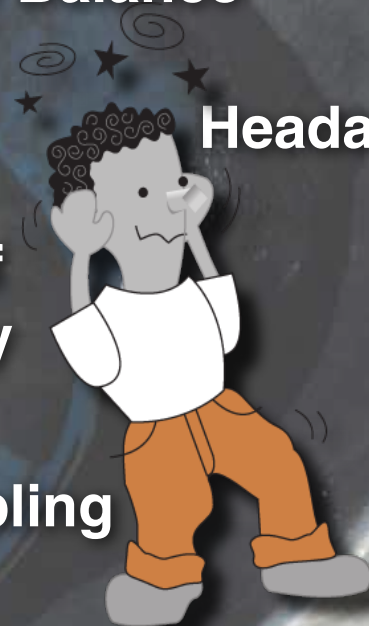
Lack of Balance

Headache

Loss of memory

Trembling

Lack of coordination



**Changes
in
emotions**

Women and children



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Mercury is especially dangerous for unborn babies and children because they are smaller and their brain is still developing. Mercury must always be kept away from kids and pregnant women - even women that could be pregnant. This includes keeping them away from clothes, spaces or things that have been used to burn mercury or in contact with mercury vapor.

What is a retort?

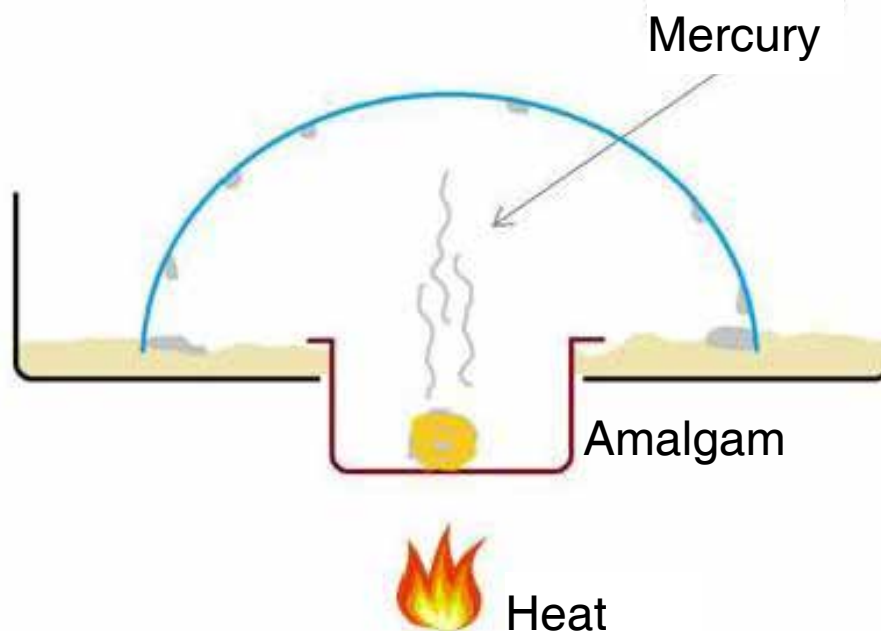


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A retort is a simple device used to capture invisible mercury vapors and turn them back into liquid mercury. This mercury can be reused to get more gold, or when miners stop using it, it can be stored.

Retorts can help prevent breathing the dangerous mercury vapors, but they are not perfect and do not collect 100% of the mercury.

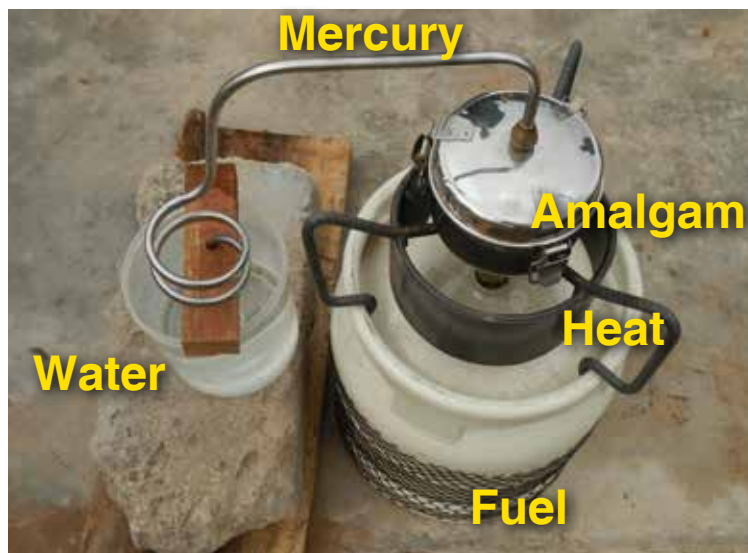
Even the best retort will let some vapor escape (5-20%). If not used properly, retorts will not protect the user and may make exposure worse, for example if it is brought indoors or people stay too close to it while it is operating.



How does it work?

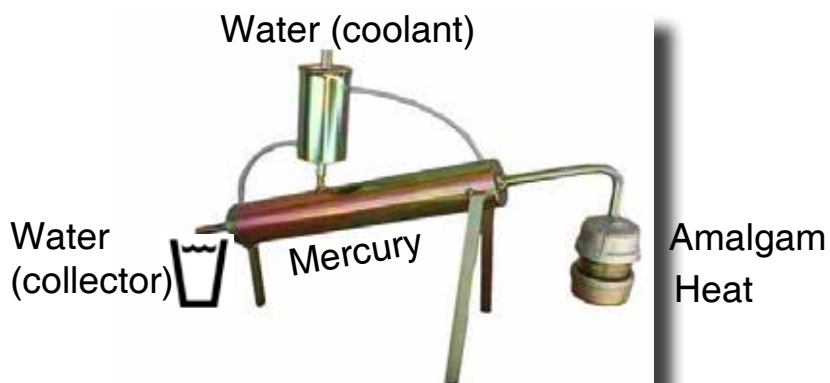
1. The amalgam is placed in the retort. 2. The amalgam is heated. 3. The mercury turns into vapors. 4. The retort catches the vapors. 5. The vapors cool down. 6. The mercury returns into liquid and drips down into water or sand. 7. Mercury can then be recovered.

Retorts come in many different shapes



Fauzi retort (Indonesia, locally-made): the mercury is collected into water.

Glass bowl retort (Mozambique, CASM project, locally-made): the mercury is collected into wet sand.



Pipe retort (South America, locally-made): the mercury is collected into water.

How to use a retort safely?

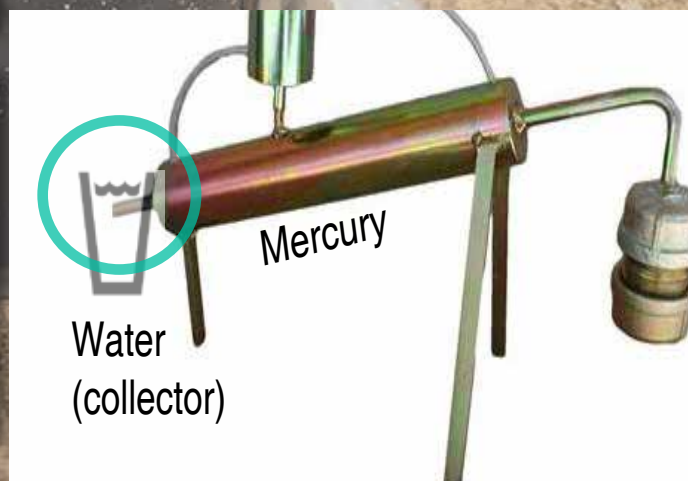


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Instructions:

Set-up your retort as demonstrated by your instructor. This will vary depending on the types.

1. Place your amalgam into the retort and close it securely
2. Place the retort above heat source.
3. If you are using a type of retort that collects mercury into a water bowl, place the end of the retort pipe under water. Make sure to keep the heat constant or water could be sucked up the pipe and cool the retort.
4. Heat the amalgam until all of the mercury is evaporated (the time varies - depending on heat source, size of amalgam, etc)
5. Wait for the retort to cool. Quenching (cooling it with water) is okay, but don't open the retort while it is still hot. If you do, mercury vapours will escape and contaminate you.
6. Check your sponge gold color to guess if all the mercury is gone. If not, then use the retort again.



Retorts DO's and DON'Ts



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DO use a retort outdoors to avoid vapors depositing on indoor surfaces. If it is used inside a retorting centre, limit the time you spend inside that facility as it will be highly contaminated.

A retort **MUST NOT** be used by women or children.

DO NOT open a retort before it is completely cool to the touch, or else vapors will still escape.

DO use the retort far away and downwind from the village or houses

DO NOT store a used retort and the clothes of the user indoors (unless it is a retort centre). **DO** store it into a dedicated place - outside the houses, and away from women and children.



Locate the retort or amalgamation center far from the village, and downwind from it.



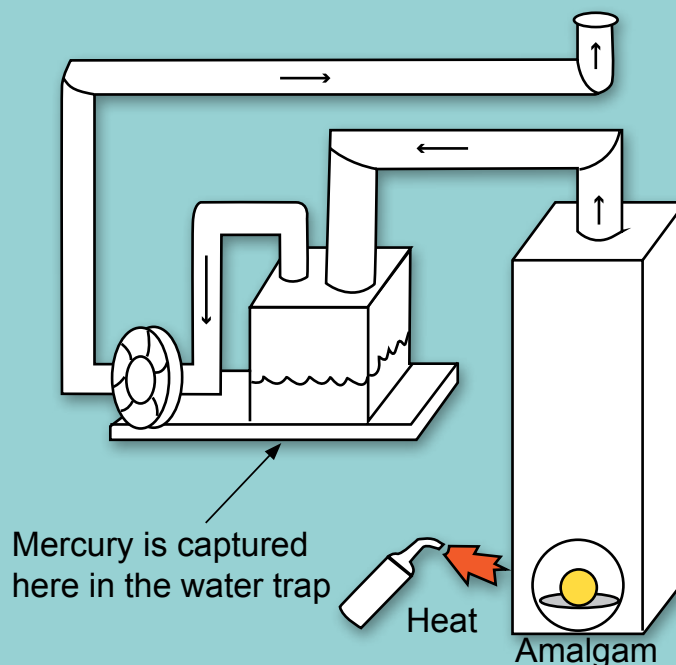
Fume Hoods



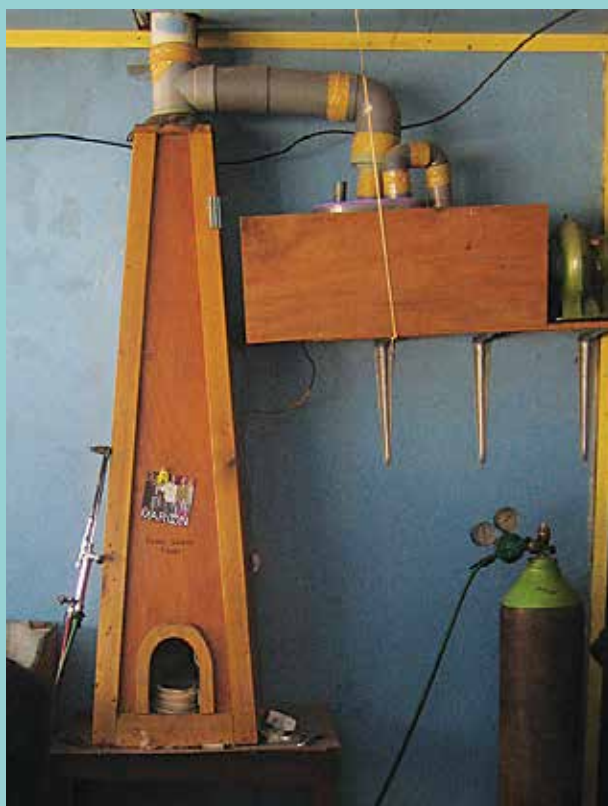
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Sometimes, people will burn their amalgam indoors, especially in gold shops. In this case, a simple retort will not be enough to protect against mercury vapors. A fume hood needs to be used.

A fume hood, with mercury capture system, can reduce the mercury lost in the air and human exposure to mercury vapors. Good and cheap system can capture up to 80% of emissions. More expensive and complicated systems can sometimes capture more. Two different fume hood types are presented here.



example *The waterbox mercury condenser is a cheap and easy-to-manufacture add-on to small fume hoods like chimneys used in many gold shops. Mercury vapor is pushed through the system by a fan. The vapor goes through water in the plastic vessel and cools. This causes the mercury to condense as liquid mercury and sink below the water.*



Fume Hoods



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example *This fume hood design by the USEPA uses common fuel drums, plates and a fan to trap mercury vapors. The drum is attached to the fume hood exhaust system of a gold shop. Mercury collects inside the drum.*





A photograph of a woman washing a young child in a large metal bowl filled with water. The woman is wearing a yellow and black striped shirt and a white headwrap. The child is wearing a blue shirt. The scene is outdoors on dry, reddish-brown soil. A large, thick red 'X' is superimposed over the entire image, indicating that this practice is discouraged or unsafe.



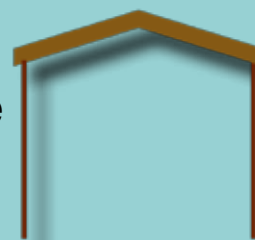
Wear gloves when stirring amalgam manually, or use a stirring stick.



If you can find an activated charcoal respirator, use it! It is the only one that works. Dust masks and fabric do not stop mercury.



A good idea is to create an amalgamation center to use retorts away from residences where all the material is left and secured at the end of the day. It will become contaminated so time spent inside the centre should be as limited as possible.



Future solutions...



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Although retorts can reduce the amount of mercury that people breathe and the amount of mercury that gets into the environment, they are not perfect and so areas where retorts are used will always ultimately become contaminated. Mercury lasts a long time and is hard to get rid of.

The use of mercury is easy but it is actually not very good at capturing gold compared to some other methods. It is a good idea to start investigating mercury free methods now and to try to switch to them as soon as is feasible. In the meanwhile use retorts properly and protect yourself, your community and the environment.

Some ideas on mercury free methods are shown the Practical Guide on Reducing Mercury in Artisanal and Small Scale Mining. It is a publication sponsored by the United Nations Environment Program (UNEP) and the United Nations Industrial Development Program (UNIDO). You can find a version of it in English, French or Spanish at the following website: www.artisanalgold.org



Partnership Africa Canada (PAC) and the Artisanal Gold Council (AGC) collaborating on the development of a mercury free artisanal gold mining site in the Democratic Republic of the Congo (DRC) photo of the executive director of the AGC, Kevin Telmer taken by Shawn Blore of PAC.



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agc@artisanalgold.org
www.artisanalgold.org
Twitter: @artisanal_gold
Facebook: Artisanal Gold Council

101-732 Cormorant Street
Victoria, BC, Canada, V8W 4A5
Tel +1.250.590.9433
Fax +1.250.590.9438