



Promoting Mercury-Free Technology in Small-scale Gold Mining (SGMs) Sector in Uganda

Strengthening the Capacity of Artisanal Miners to
Ensure Sustainable Gold Production and Livelihood



Funded by the Swedish Society for Nature Conservation

Continued use of mercury in ASGM sector presents a serious health impacts to community livelihoods and the environment as mercury pollutes community waterways, soil and food despite education and sensitization by civil society organization and conservationist. Access and or cost of effective alternatives to replace mercury in gold recovery could perhaps be the reason.



A typical mine in Tiira mining area in Busia district.

Alternatives to Mercury in ASGM exists

There are many technologies that do not involve the use of mercury in the gold recovery process. These include: Gravity Concentration: Sluice Boxes, Shaking Table, Centrifuges; Complexing Techniques: Chlorine Processing, Cyanide Processing (Dangerous), Other Halides, Flotation Methods; Agglomeration Processes and Electrolytic Processes. All of these processes have advantages and disadvantages, which would favour the selection of one or the other. Most are friendlier to the environment and human health in comparison to the mercury amalgamation process; this makes them the preferred methods for reducing or eliminating mercury in ASGM.

There are two obstacles preventing effective transition away from mercury use in ASGM to alternative techniques, and these are: cost and know-how.

The key activity that will promote the use of mercury free technologies is education and awareness.

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Despite the threats its poses to health and environment, mercury a highly toxic chemical, has long been used by artisanal and small-scale miners globally despite the threat it poses to their health and the environment.

Whole ore amalgamation also put miners at risk of being poisoned by mercury

The Mercury: Widely used in ASGM but poorly understood

Mercury has played an essential, if not efficient, role in gold recovery for much of history. While industrial gold operations today are not heavily dependent on its use, artisanal and small-scale gold miners (ASGM) remain tied to its use due to lack of affordable healthier, cost effective and more efficient alternative. This is perhaps the reason mercury has for millennia been indispensable in the ASGM sector. Miners have continued to add liquid mercury to the crushed ore where it binds with tiny particles of gold, then is clumped into amalgamated pellets that miners heat, vaporizing the potent neurotoxin mercury into the atmosphere, leaving behind the more concentrated gold. Both processes of amalgamation and vaporization to purify the concentrate presents a serious health risk to the entire mining community and the environment.

Most mining areas bear semblance to a village rather than a mine site, as residential houses are clustered around the mining area with children run around everywhere. Besides, inefficient and dangerous practices of gold recovery are seen at every stage of the mining process for example, crushing of ore emits a lot dust which has respiratory effect, and deafening noises from ball mills. Whole ore amalgamation also put miners at risk of being poisoned by mercury.



In Budde gold mining area all artisanal miners use mercury (the dancing liquid metal) because it pulls gold dust together into a solid nugget. The nugget is then burn over open fire or touch to get rid of the mercury and produce solid gold. The miner is only concerned about making money, and not conscious of the consequences of his action. The people around him, and even the entire mining community are at a risk of being poisoned.

Artisanal miners are perhaps not aware that direct mishandling of liquid mercury can cause a number of health impacts, such as corrosion to the skin, eyes and gastrointestinal tract. They may also not know the symptoms of exposure, which include tremors, insomnia, memory loss, neuromuscular effects, headaches and cognitive and motor dysfunction.

Some mining areas bear semblance to a village rather than a mine site. People reside within the mines, and are therefore, impacted by the inefficient and dangerous practices of gold recovery at every stage of the mining process for example, dust pollution from the crushing of the ore, deafening noises from ball mills, risk of chemicals poisoning etc.



Children watching a miner vaporizing a nugget over open fire to gold, Budde mine, Bugiri district, 2017



*A boy handling mercury with bare hands,
Budde mining area, Bugir district*

Government's Efforts to reduce Mercury use in the ASGM Sector in the Country

In Uganda, the use of mercury in artisanal and small-scale gold mining has been on the rise. Mercury is a known neurological toxicant that has the potential of negatively impacting the different communities; both in the mines and outside the mines that are exposed to mercury poisoning. The growing use of mercury among the mining communities in the country and the risks associated with mercury poisoning call for deliberate efforts well-coordinated interventions from government, Civil Society organizations (CSOs), the private sector and from all the other stakeholders.

With the Minamata Convention on Mercury coming into force, parties to the Convention in collaboration with their national and international civil society are building partnerships for advocacy to raise awareness on the dangers associated with mercury and to promote less harmful alternative mining practices in ASGM which do not involve the use of mercury.



Women miners practising panning for gold after a training on gravity concentration by NAPE and team, in Beheeri, Namayingo district

The National Environment Management Authority (NEMA) is the National Focal Point for the Minamata Convention in Uganda, and has been implementing a number of activities aimed at meeting the country's obligation to elimination and or reducing mercury use which include: developing the National Action Plans to reduce the use of mercury and mercury compounds, conducting Initial Assessment (MIAs) in Africa – 2015 – 2017 aimed at strengthening national efforts to ratify the Convention, and established annual release of mercury to the environment (MIAs), requested ministries, department and agencies, the private sector, Civil society to develop specific Mercury Pollution Reduction Action Plan, Government through NEMA has developed education and information materials to enhance awareness on mercury, media publications and talk shows, and collaboration with civil society regarding alternatives in ASGM among others.

NAPE and other civil society organizations have already built partnership with NEMA to implement activities that aim to eliminate or reduce the use of mercury in ASGM

Promoting Alternative Technology in ASGM in Uganda

The use of mercury in ASGM is persistent despite efforts to educate and sensitize miners about the health and environmental impacts of mercury. The slow shift by miners to a safer gold recovery alternative is perhaps due to the limited choices, and costs of alternatives in the matter. For this reason, artisanal miners may continue to use mercury for so long as they perceive that the benefits of mercury technique outweigh the costs. In order to shift attitudes and behavior in ASGM, miners must be made aware of the potential health consequences from mercury and introduced to new techniques that minimize the amount of mercury used or replace mercury amalgamation with safer alternative. According, mercury remains relatively accessible as gold buyers often avail it to miners on site. Secondly, there no special equipment needed for its use in amalgamation, so it is easy for miners to use and even move from one location to another as they seek out richer gold deposits.

To this end, NAPE acknowledges that training miners in alternative gold recovery methodology is a powerful tool in changing unsustainable patterns of gold production. In partnership with National Association of Community and Occupational Health (UNACOH) and the Department of Occupational Safety and Health (DOSH) in the Ministry of Gender, Labor and Social Development (MGLSD). NAPE is implementing a project aimed at

promoting mercury-free technology in the districts of Mubende, Buhweju / Ibanda, Bushenyi, Bugir, Namayingo, Busia, Moroto, Nakapiripirit and Amdat. The project is funded by the Danish Government through Diálogos, a member of the network of NGOs in Denmark involved in health-related projects worldwide to reduce the health and environmental footprints caused by mercury in small-scale gold mining sector.

The objectives of the project are;

- To help miners transition from the use of mercury to a more user friendly, less harmful and productive methodology using Borax in artisanal gold mining
- Improve the health, social and economic welfare of miners as well as conserve the ecosystems around and linked to gold mining areas.
- To advocate for the review of the mining policies to include artisanal mining sector and formulate regulatory frameworks and guidelines to govern the sector

Many technologies exist that do not involve the use of mercury in the gold recovery process. These include – Gravity Concentration: Sluice Boxes, Shaking Table, Centrifuges; Complexing Techniques: Chlorine Processing, Cyanide Processing (Dangerous), Other Halides, Flotation Methods; Agglomeration Processes and Electrolytic Processes.

Promoting Alternative Technology in ASGM in Uganda

All of these processes have advantages and disadvantages, which would favour the selection of one or the other. All the technologies except Cyanide processing are friendlier to the environment and human health in comparison to the mercury amalgamation process; this makes them the preferred methods for reducing or eliminating mercury in ASGM. However, promoters of alternative techniques have identified the cost of some alternative technologies and the technical know-how as the biggest obstacles that is causing the slow transition away from mercury use to alternative methods by artisanal miners in Uganda. The crucial activity that will increase the use and promotion of mercury-free technologies therefore, is education and awareness.

The project is promoting the Borax methodology. The “borax method” is a short-hand term for a range of methods to improve the concentration of gold in ore without using mercury, so that the ore can be directly smelted (with borax or another flux). Borax does not replace mercury directly in gold extraction process. It is used at a different stage of the process, that is, during smelting. Nor is it always a mercury-free process as miners often use borax in conjunction with mercury. In order to be able to directly smelt gold ore using borax, the concentration in the ore must be around 25% or greater. To create such high-grade material improved concentration methods must be applied. These improved concentration methods (and the subsequent use of borax) do not represent a simple one-to-one replacement of mercury for another chemical, but usually require new or improved processing techniques, and will generally require training and assistance to promote their adoption.

The Borax method has three major advantages over amalgamation methods, and these are:

- Mercury, a known toxin, is not used;
- Gold capture is improved;
- The borax method is cheaper than the amalgamation method

Training of Miners in Gold recovery using Borax

Crushing of the ore



Miners being taught how to crash ore and do wet milling by Alma Torrejos Andoy and Rizalde Perez from Philippines

NAPE and her project partners have identified and mobilized selected artisanal miners and trained them in the Borax technology so that they train their fellow miners in the Borax methodology, and encourage them to stop the use of mercury in their mining activity because of the socioeconomic and environmental impacts mercury poses.

The project facilitated the construction of two demonstration sites for training artisanal miners in the Borax technology. The project partners carried out a Training of Trainers (ToT) for 30 ASGM miners on the Borax technology from seven districts of Uganda - (Mubende, Buhweju, Bugir, Namayingo, Busia, Moroto and Nakapiripirit). Fifteen (15) ASGM miners sourced from Central and Southern Uganda were training in Mubende and another 15 ASGM miners from East and Northern Uganda were trained in Namayingo respectively. The miners were excited to learn the Borax methodology and expressed willingness to switch to use of Borax after they realized they recover more gold.

But what is the Borax methodology?

Borax is a short-hand term for a range of methods to improve the concentration of gold in ore without using mercury, so that the ore can be directly smelted with borax. Borax therefore, does not replace mercury directly in gold extraction process. It is used at the final stage of the process, that is, during smelting. In order to be able to directly smelt gold ore using borax, the concentration in the ore must be around 25% or greater. To create such high-grade material, improved

Sluicing Process

Ball mill where the ore was crashed to make fine particles

Sluice boxes were the crashed ore was powered and water added

Basin of water were the captured ore was washed

concentration methods must be applied. The improved concentration method, and the subsequent use of borax requires a new or improved processing techniques a require training and assistance to promote their adoption. Concentration means increasing the amount of gold in ore or sediment, by selectively removing lighter particles. If employed effectively, concentration methods can eliminate or greatly reduce the need for mercury. And better concentration usually requires a higher level of organization. The project identified experienced trainers from the Philippines who have used the Borax method to train artisanal miners in Uganda.

Training of selected miners: using Concentration Method

Before concentration began, the ore was crushed or milled to liberate gold particles from rock and to decrease the grain size. Miners were told that concentration works best when grain size of the milled material or sediment is relatively consistent, so that most particles are of similar size. When the crashed material realized the appropriate grain size, then miners employed gravity concentration method or panning.

The crashed ore was then poured in a sluice box and a water was used to wash alluvium down a series of angled plat-forms. As water washes sediment down a sluice, gold particles sunk and were

Panning Process

captured by carpets that were covering the bottom of the sluice.

As the moving water run-down the sluice, it generated greater force and kept gold particles from sinking and the particles were captured on the carpet on the bottom of the sluice. The carpets on the bottom of sluices was removed and washed in a bucket to remove the captured dense materials, mostly gold.

The material that was captured was then panned in a pond to further concentrate the amalgam.

After the sluicing process, miners then washed the materials from the basin in a pond of water. Sediment thought to contain gold is placed in a pan along with water. The miner then moved the pan in a series of motions designed to eject lighter sediments. The density of gold keeps it on the bottom of the pan as lighter materials were ejected along with water. After a series of successful repetitions of moving the pan were completed, gold was be exposed on the bottom of the pan for the miner to recover.

Miners practicing panning process in a pond



Smelting of the amalgum with Borax

This was the final stage when borax was added to the concentrate and heated.

At this point in the process, direct smelting was employed as the final stage of gold recovery. Borax was added to the concentrate then heated until it melted. The liquid is then cooled to form a solid mass of gold.

Rizalde Perez showing miners to use Borax at the point of smelting the concentrate



A miner holds the sold mass of clean pur gold was reverer after smelting with Borax.

Awareness Campaign on Sound Chemicals Use and Management with Emphasis on Mercury.

NAPE has been carrying out a series of awareness campaigns and workshops on sound use, management and disposal of chemicals including mercury and their impacts health and environment in many communities and schools (both primary

and secondary) in Kampala, Hoima, Masindi and kiryandongo districts. NAPE has also held radio talk-show and debates on national and local radio stations on the impacts of chemicals on health and environment.

The aim of involving school children and communities in the sound use and management of chemicals in their daily life is to build and strengthen the capacities of the general public on the safe use of chemicals including mercury so that everyone becomes aware and help to reduce the environmental and health footprints caused by unsustainale use of chemicals leading to ill health.

At local level, NAPE has mobilized and help communities to form groups, grassroot associations and Community-Based Organizations (CBOs) on Sound Chemicals Management. In 2010, NAPE formed and is hosting a National Network on Sound Management of Chemicals ((NESMAC-U), to which the loose grassroot networks and groups on Sound Use and Management of Chemicals are affiliated.

NAPE provides guidance and sometimes small financial support, including linking these grassroot associations and organizations to bigger organizations nationally and globally to share experiences, knowledge, resources that will help them grow.



NAPE raising awareness on the impacts of chemicals to health and environment at Standard Primary School, Zana, Kampala



Miner practising panning for gold after a training on gravity concentration by NAPE and team, in Beheeri, Namayingo district



Representatives of NAPE and Bullisa Initiative for Rural Development Organization (BIRUDO) in a radio talk show on impacts of chemicals to health and environment at Community Green Radi Studio in Hoima.



NAPE and partners in an engagement meeting with local leadership in a mining area in Mubende

NAPE's Other Programms and Projects

in the country, NAPE is also implementing the following projects and programms among others:

Shared Resources Joint Resources (SRJS) in Uganda:

In partnership with the African Institute for Energy Governance (AFIEGO) and the Environmental Trust of Uganda (ECOTRUST), NAPE is implementing the program in the Queens and Murchison landscapes in West and North-Western Uganda. The program focuses on strengthening partnerships for CSOs lobby and advocacy to promote international Public Goods (IPGs) i.e. Food security, Water supply, Climate resilience and Biodiversity in the two landscapes.

The Green Livelihoods Alliance (GLA) Programm in Uganda:

The program focuses on securing forest landscapes in Kalangala and Buvuma Islands in Lake Victoria. The program also aims at providing legal guidance/services in face of rampant land-grabbing for large-scale foreign-driven investment projects especially in agribusiness. The two Islands have been earmarked by government for palm oil growing.

Sound Chemicals Management project:

The project focuses on raising awareness on the negative impacts of chemicals on health and the environment. The project also education and sensitization of the general public on the sound use and management of chemicals are part of our daily life and aims to influence national and international instruments that govern the use, manufacture, trade, transportation, storage and including disposal of hazardous chemicals. The project also promotes Mercury-freed gold mining technology among artisanal gold mining communities in seven districts of Uganda.

Sustainability School Programm:

The program employs popular education approach to advocate and build communities capacity to effectively participate in in social economic and political change processes in the country. The program aims to transfer power from dominant groups (elites,

NAPE's Other Programms and Projects

politically & economically powerful) to the poor, marginalized, disadvantaged and disenfranchised. The program also focuses on training activists to assist communities in problem solving in regards to their daily life associated to unsustainable practices and challenges that arise from environmental hazards and unintended effects of developmental projects.

Gender and Building National Rural Women's Movement:

The gender and women's movement focuses on promoting gender parity in the management of natural resources, and women's rights, especially the grass-root women. The project also aims at mobilizing and organizing women to build an eco-feminist collective power for a democratized people-owned and controlled energy systems, women's rights, food sovereignty, climate and environmental justice through campaigns and collective actions.

Strengthening community cultural governance systems to protect and defend community food, land, and natural heritage.

The project focuses on promoting people and women-centered approaches to livelihoods and Earth jurisprudence, community conservation resilience initiatives, and reducing deforestation and forest degradation (REDD)

Communication and Publications Project:

The project aims at raising NAPE's visibility through dissemination of NAPE's work and research reports on various media channels, online platforms and physical meetings. NAPE's communications aim to effectively create a microphone that gives a voice to the subjects of change, builds networks for common struggles and gives priority to transformation and solutions to social and environmental injustices.

About NAPE

OUR VISION

envisages a Ugandan society that effectively participates in the sustainable management of natural resources

OUR MISSION

promote sustainable use of environmental resources in Uganda, through training, research, information sharing, advocacy and advisory services so that the people are able to contribute to national development

OUR MANDATE

NAPE is legally authorized to undertake actions and initiatives that promote sustainable, and equitable management of natural resources in Uganda

The National Association of Professional Environmentalists (NAPE)

was formed in 1997 and is a registered indigenous Environmental Non-governmental organization (NGO) that works on a number of issues with specific focus on lobbying and advocacy for sustainable use of natural resources in Uganda.

NAPE's Development Goal

The following are NAPE's key targets to achieve improved management of natural resources in Uganda:

- Promotion of gender parity in the management of natural resources
- Enhancement of good governance in the management of natural resources
- Increase in public awareness on best practices in natural resources management
- Mitigating effects of environmental / climate change through sound management of natural resources
- Developing and enhancing the capacity of NAPE to achieve its objectives

About NAPE

OUR CORE VALUES

NAPE is legally authorized to undertake actions and initiatives that promote sustainable, and equitable management of natural resources in Uganda

Teamwork & Commitment:

NAPE gives due importance to working together to achieve a common objective, respecting each other's contribution, realizing and appreciating that togetherness is prime to accomplishment of tasks.

Transparency & Accountability:

NAPE believes in being open in all ways and at all times, telling the truth, ensuring that resources are effectively and efficiently used, in the interest of every one.

Respect:

NAPE places high value on the preservation of life, property, and the environment.

Integrity:

NAPE expects its members and other networks/partnerships to conduct themselves in a manner beyond reproach



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