

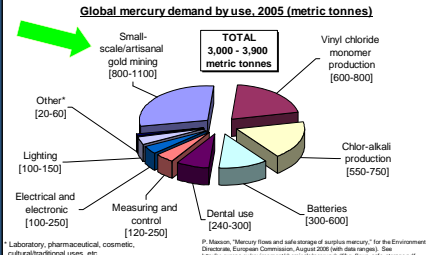
Artisanal and Small Scale Gold Mining and Mercury Pollution



Mercury Pollution: A Global Problem Warranting International Solutions

- Mercury (Hg) cycling threatens global fish supply
- Primarily risk for pregnant women, children & sub-populations dependent on fish & marine mammals
- Artisanal & Small-Scale Gold Miners experience acute health impacts
- W.H.O. (2005): mercury may not have a safe threshold of exposure

2005 Mercury Uses by Sector



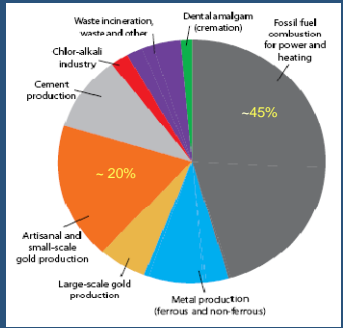
Global mercury demand by use, 2005 (metric tonnes)

TOTAL 3,000 - 3,900 metric tonnes

- Small-scale/artisanal gold mining [800-1100]
- Vinyl chloride monomer production [600-800]
- Chlor-alkali production [550-750]
- Batteries [300-600]
- Dental use [240-300]
- Measuring and control [120-250]
- Electrical and electronic [100-250]
- Lighting [100-150]
- Other* [20-60]
- Fossil fuel combustion for power and heating (~45%)
- Artisanal and small-scale gold production (~20%)


* Laboratory, pharmaceutical, cosmetic, cultural/traditional uses, etc.

2005 Mercury Emissions by Sector



ASGM and Mercury

- Source of livelihood for 10-20 million people
- ASGM represents about 1/3 of the total worldwide mercury consumption
- Mercury is:
 - Cheap
 - Easily accessible
 - Quick
 - Easy to Use
 - Independent
- Up to 1500 ton/yr:
 - 40% to atmosphere,
 - 60% to aquatic systems



Blue Reef Small Scale Gold Mine (Tanzania)

Tolmer, H. and Veiga, M. 2009. "World Emissions of mercury from artisanal and small scale gold mining and the knowledge gaps about them." In: Mercury: Fate and Transport in the Global Atmosphere, in N. Pirrone and P. Mason (eds.) Mercury: Fate and Transport in the Global Atmosphere. DOI 10.1007/978-0-387-69399-2_68 Springer Science. See www.mercurywatch.org

Global Mercury Project. Final Country Report for Tanzania. November 2007 (Photo)

http://www.globalmercurywatch.org/countries/tanzania/tanzania.htm

International Response to Mercury Use in Artisanal and Small Scale Gold Mining

Restricting Trade

Figure 4 Commodity mercury shipments among world regions, 2004

From: UNEP Chemicals, Summary of Supply, Trade and Demand Information on Mercury, Nov. 2006

Export Restrictions

- EU ban on mercury exports begins 2011
- US ban on mercury exports begins 2013
- Together these account for roughly 1/3 of global supply
- In 2010, price has doubled

UNEP Global Mercury Program: ASGM Partnership

ASGM National Strategic Plan Formulation Process

Graphic courtesy of BanToxics

Reducing High Risk Practices

Large amounts of mercury used when mixed with whole ore rather than concentrate

GMP- Pilot project for the reduction of mercury contamination resulting from artisanal gold mining fields in the Manica district of Mozambique (Photo) http://www.globalmercuryproject.org/countries/mozambique/docs/Moz_Final_Report_Aug_2005.pdf

Reducing High Risk Practices

Open-air burning of gold-mercury amalgamate. Hg is emitted directly to the atmosphere and human exposure is extremely high

Mixing contaminated amalgam tailings with cyanide creates more mobile forms of mercury

Communities and Small Scale Mining (Photo): http://www.ied.org/mrmsd/mrmsd_pdf/asam_ghana.pdf
 GMP- Pilot project for the reduction of mercury contamination resulting from artisanal gold mining fields in the Manica district of Mozambique (Photo) http://www.globalmercuryproject.org/countries/mozambique/docs/Moz_Final_Report_Aug_2005.pdf

Promoting Cleaner Technologies



A locally fabricated retort

Miner re-activating mercury using a radio battery; the process takes about 10 - 20 minutes

Global Mercury Project, Final Country Report for Tanzania, November 2007 (Photo)
<http://www.globalmercuryproject.org/countries/tanzania/tanzania.htm>
 GMP - Manual for Training Artisanal and Small Scale Gold Miners (Photo)
http://www.globalmercuryproject.org/documents/tan_country%20specific%20training%20manual%20for%20miners%20March%2015.pdf

Exploring market-based approaches

- Raising funds through gold branding
- Labelling and certification
 - Alliance for Responsible Mining (ARM) and Fairtrade Labelling Organization (FLO) have developed Fair-Mined/ Fair Traded "Standard Zero" for ASM gold, silver and platinum

Mercury: A New Beginning

- International mercury treaty to be signed 2013
- For ASGM this means:
 - Reduced supply = Higher mercury prices
 - Reduction targets for ASGM emissions
 - How to build incentives to achieve targets?
 - Financial mechanism for assistance

Approaches to Reduce the Use of Mercury in
Artisanal and Small Scale Gold Mining

Under

THE SUSTAINABLE MANAGEMENT OF MINERAL
RESOURCES PROJECT, TANZANIA

By John M. Nayopa
Project Co-ordinator

SMMRP Overview

- SMMRP is a 5-year technical assistance project (2009-2014)
- Project Financing:
 - IDA Credit - USD 50M
 - Government of Tanzania - USD 5M
- Coordinated by MEM through the Minerals Division and the Geological Survey of Tanzania (GST)

SMMRP Objectives

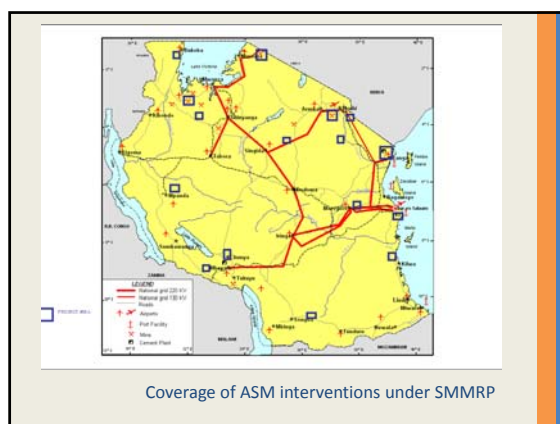
- Strengthen the Government's capacity to manage the mineral sector
- Improve the socio-economic impacts of large and small-scale mining
- Enhance private local and foreign investment in the mineral sector

SMMRP Components

- **Component A:** Improving the Benefits of the Mineral Sector for Tanzania
- **Component B:** Strengthening Governance and Transparency in Mining
- **Component C:** Stimulating Mineral Sector Investment
- **Component D:** Project Coordination, Management, Monitoring and Evaluation

ASGM INITIATIVES

Period	Program	Scope
1990-1994	DAR TADINI TRADING	Gold buying in ASM areas: Geita, Chunya and Tatumbe. Some extension service was also offered to ASAs
1995-1998	Gold Buying Scheme by BoT	Gold buying from ASM through national Bank of Commerce
1995-2000	MSD-TA	WB funded Technical assistance Project that strengthened extension service and ASM Associations
1998-2001	MEREMETA SCHEME	Gold buying from ASM in coupled with technical assistance to SSM (equipment)
2002-2004	Global mercury Project	Removal of barriers to the Introduction of Cleaner Artisanal Gold mining and Extraction Technologies-A case study of Geita
2007-todate	Fair Gold trading by APM	Gold buying from ASM in Geita, Bukombe and Mago districts coupled with technical assistance to SSM (information on gold price, assaying and finances)
2008-todate	NORTH MARA ASM PROGRAM	Financial assistance to ASM cooperatives around North Mara area for mine development, equipping and process plant
2008-todate	WILAMSON PARTNERSHIP	Financial assistance to enhance extension service to ASM around Mvuluni area



SMMRP Baseline studies

- The ASM assessment Will establish the present situation in the field, including the impacts, behavioral changes and legacies of past interventions

SMMRP Extension Services

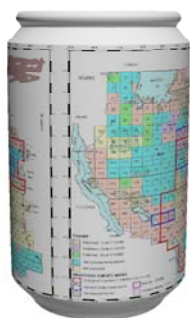
- This will strengthen ZMOs, RMOs and ASM trainers to address issues inmining such as processing technology, environment, and health, community consultation, training, and organization and formalization of artisanal mining activities

SMMRP environmental and social programs

- SESA and PSIA studies will be used to develop relevant governance and social accountability indicators and recommend measures aimed at mitigating any potentially adverse impacts.
- Awareness programs and promotion of good practices will be done




Contemporary Photo Album




Choose a layout...

...then click the placeholders to add your own pictures and captions.




On the **Picture Tools | Format** tab, you can create your own frames and make picture corrections such as adjusting contrast and brightness or cropping the picture for just the right look.




Picture Quick Styles give you great looking "frames" in a single click.




A collage of images including a pile of stones, a map can, two men in hard hats, and people working with a large bowl.



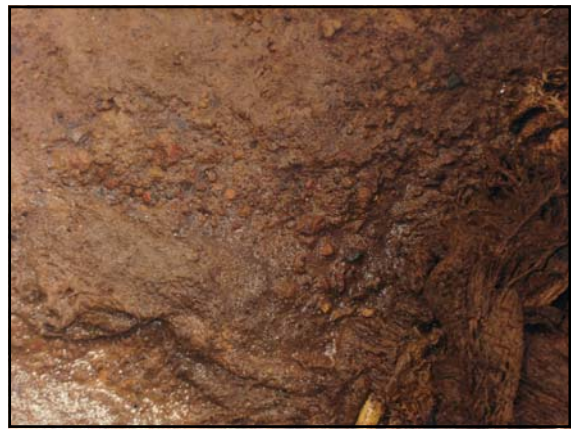
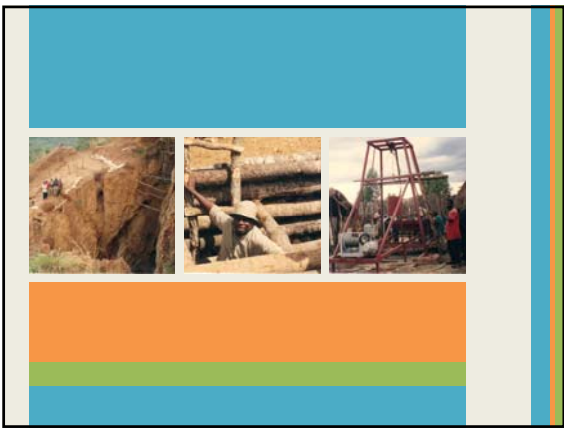
A slide layout with a blue header bar, a row of three photos showing people in a village, and a footer with orange, green, and blue bars.



A slide layout with a blue header bar, a row of three photos showing construction and people, and a footer with orange, green, and blue bars.



A slide layout with a blue header bar, a row of three photos showing a group of people, and a footer with orange, green, and blue bars.



MINISTRY OF ENERGY AND MINERALS ASM OVERVIEW IN TANZANIA

MEETING ON ASGM AND MERCURY USE
IN TANZANIA; HELD AT WB PREMISES,
DSM ON 15 OCTOBER 2010

Presenter:
Alex A. Magayane
Asst. Commissioner – Small Scale Mining Development

10/18/2010

MINISTRY OF ENERGY AND
MINERALS

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OUTLINES

1. GENERAL ASM OVERVIEW
2. AS GOLD MINING
3. INITIATIVES TO ADDRESS ASM ISSUES IN TANZANIA
4. INITIATIVES TO MINIMIZE Hg HARZARDS
5. CHILD LABOUR
6. GENDER EQUITY
7. CONCLUSIONS

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1. GENERAL ASM OVERVIEW IN TANZANIA

- Artisanal and Small Scale mining activities (ASM) have been carried out in Tanzania since the colonial days.
- They mainly involve the mining and extraction of gold, gemstones and a variety of building and industrial minerals.

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GENERAL ASM OVERVIEW Cont.

- Tanzanian communities recognise ASM as anyone engaged in mining; from the owner of PMLs through labourers, illegal miners, mineral brokers, mineral dealers, speculators, service providers, to pit and/or mine supervisor.
- Baseline survey conducted in late 1996 estimated ASM to range from 550,000 to approx. 1,000,000 people; Ratio of individuals in the **gemstones to gold to other types of minerals** being 11:8:1.

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GENERAL ASM OVERVIEW IN TANZANIA Cont.

- According to the Mining Act 1998: ASM activities are those operated under a Primary Mining Licence (PML).
- MEM has adopted the universal definition for ASM that refers to mining activities that are labour intensive; and employ traditional techniques.

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2. AS GOLD MINING

- Mining, milling, processing and recovery of gold by the ASM have been experiencing the use of rudimental equipment.
- To some extent mining methods have been improved relative to other processes (millings, crushing, sluicing, and concent.).
- The big problem occurs at the stage of gold recovery where amalgamation is the main method of recovery.

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6

Existing Mining Practice

Poor Practice **Good Practice**

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AS GOLD MINING ...Cont

- Mercury is so often used due to its ease of application, the independence it affords the miner (one person can use it effectively), its high effectiveness under field conditions, availability, relative low cost (how much compared to the price of gold per carat?) relatively quicker process (one day for processing), its use to divide profits, and (for indentured miners) lack of choice of an alternative.

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Poor practice on Processing methods

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3. INITIATIVES TO ADDRESS ASM ISSUES IN TANZANIA

- In 1995, a directorate was established under the Division of Mines to deal with artisanal and small-scale mining. The Directorate only lasted up to the end of the MSD Project.
- MEM established a permanent section under the Minerals Division to oversee SSM development to ensure sustainability in addressing the ASM issues.

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4. INITIATIVES TO MINIMIZE Hg HARZARDS

- Include the Global Mercury Partnership of the United Nations Environment Programme (UNEP) and the Global Mercury Project (GMP).
- The GMP was established in 2002 and worked in six countries including Tanzania, introducing cleaner technologies, training miners, developing regulatory mechanisms,

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INITIATIVES TO MINIMIZE Hg HARZARDS...Cont.

strengthening governance and building the capacity of local laboratories and health authorities to monitor mercury pollution.

- Professor Niels and Dr. Jesper Bosse from the Department of Geography and Geology University of Copenhagen told the ministry, **"We have now finished our borax project in the districts of Chunya and Manyoni with some promising initial findings."**

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INITIATIVES TO MINIMIZE Hg HARZARDS...Cont.

Most of small-scale miners embraced the idea of extracting gold by using borax instead of mercury, though some miners are still reluctant to venture into new methods. We still need to do more testing and to refine the method so that it is increasingly applicable to the Tanzanian context”.

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INITIATIVES TO MINIMIZE Hg HARZARDS...Cont.

- MEM is closely following up the research on alternative use of borax; In June 2010 MEM conducted training to 50 SSM in Chunya District on borax use as an alternative to extract Au.
- Since the mercury used in ASGM has environmental and public health impacts there necessitates the introduction of a simple alternative and safer methods available to miners to process Au.

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INITIATIVES TO MINIMIZE Hg HARZARDS...Cont.

- Currently, there is a process of reprocessing gold tailings by using cyanidation process introduced by medium and small scale miners.
- This process of recovering gold is conducted by using cyanide leaching (static leaching process/vat leaching). This process is being exercised at Geita, Bukombe and Mvomero in Morogoro

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5. CHILD LABOUR

- ASM also often involves considerable numbers of children. Children typically work in mines to help their parents and to supplement family income in order to buy basic food and clothing items. Exact numbers of children employed in mining are not known.

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Child Labour




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6. GENDER EQUITY IN Au MINING

- Women are estimated to account for more than 23 per cent of the Tanzania’s ASG miners.
- Women’s direct responsibilities in ASGM range from processing activities such as crushing, grinding, sieving, washing and panning to amalgamation of Au.

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GENDER EQUITY IN Au MINING Cont.

- However, it is less common for women to own mining concessions or to act as mine operators, buyers or sellers of minerals or equipment operators.

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7. Conclusions

The Government through the Small Scale Mining Development Section is dedicated to assisting ASGM to improve their productivity, product quality and livelihoods within the ASM communities.

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THANK YOU

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ARTISANAL & SMALL-SCALE MINING:

BASELINE SURVEY

Dar-es-Salaam, Tanzania
15th October 2010

General Overview

- ASM activities carried out for extraction of various minerals including:
 - Gold, Diamonds, Gemstones, industrial minerals (gypsum, limestone, kaolin, etc.) and others;
 - Concentration of activities mainly in gold and gemstone areas with gold taking the majority;
 - Majority Gold miners in Lake Victoria Goldbasin, mainly in the Regions of Mwanza, Mara, Shinyanga, Tabora & Singida;
 - Chunya Goldfield, Mpanda Mineral field & new non-traditional discoveries cover the rest.

GENERAL OVERVIEW

- Baseline survey carried out in 1996 indicated 555,000 ASM participants;
- Recent estimates have put the number above 1 million;
- According to the 1996 survey, women participation was around 23% with majority hindered by traditional beliefs obstacles;
- Last 10 years have seen more women in direct participation and ownership of mineral rights.

GENERAL OVERVIEW

- There has been noticeable technological development and mechanization;
- Improvements can be seen in crushing & grinding where locally made mills have become common;
- Reprocessing of tailings by using cyanide is gaining momentum;
- Overall recovery remain low due to poor processing technologies.

GENERAL OVERVIEW

- Sluicing followed by amalgamation remains the main processing technique;
- There is limited data on environmental impacts associated with technological changes;
- There is lack of data for clear understanding on the extent of use of mercury & its impacts;
- Accurate data on the technical, social, environmental & other aspects of ASM & hence its positive & negative impacts lacking.

SMMRP BASELINE SURVEY

- Baseline survey to be undertaken as part the "Sustainable Management of Minerals Resources Project" (SMMRP) - IDA CREDIT 4584-TA;
- MTL Consulting & two local partners to undertake the survey;
- **AIM:** To provide reliable quantitative information on the status and categorisation of ASM in Tanzania and to develop a MIS-based database that is updatable and that will contain important ASM indicators.

SMMRP BASELINE SURVEY

- **Sites:** To cover all the 21 Regions centred on current Mining Zones, i.e.:
 - Dar-es-Salaam; Arusha; Mwanza; Singida; Mpanda; Mbeya; Mtwara; and Shinyanga;
 - In-depth studies to obtain necessary and relevant detail will be conducted in 3 Sites, namely *Makanya, Mererani and Rwamagaza* sites - selected for their representativeness in terms of the minerals produced.
- **Sampling:**
 - **Primary data:** to be obtained through field research involving both qualitative and quantitative techniques, i.e., Questionnaire, Key Informant Interviews, Focus Group discussions, Observation, and Participatory Approaches.

SMMRP BASELINE SURVEY

Sampling:

- **Secondary information** will be obtained through literature survey and consultations from *inter alia*, the following sources:
 - MEM and related ministries, Zonal mining offices;
 - Regional and District Socio-economic Profiles;
 - Village data;
 - Village Health (MCH) Reports;
 - Tanzania Household budget Survey ;
 - NGOs and Service institutions .e.g. Banks;
 - Research reports – REPOA, ESRF, UDASM;
 - International reports – MMSD, ILO, etc.

SMMRP BASELINE SURVEY

Field Survey and methods:

- Survey Tools have been prepared to capture relevant assessment data and include questionnaires grouped into:
 - **Tool I-** Baseline Survey (*To cover all ASM mining areas*)
 - **Tool II-** Data from Zonal Mines Offices and District Officials
 - **Tool III-** Household Survey (*in 3 selected areas only*).
- **Key informant interviews (KII)**
- **Focus Group Discussions (FGD's)**
- **Observations**
- **Participatory Methods** (Stakeholder & Institutional Analysis & Gender-resource mapping).

SMMRP BASELINE SURVEY

Key informant interviews:

Individuals for the ASM Baseline study include:

- Community leaders – formal and informal (including opinion movers);
- Miners – (PML owners, Pit operators, Mine workers and Service providers in ASM);
- Mine Inspectors (from mine offices);
- NGO workers in respective areas;
- Government officials – (at Community [e.g. Extension Workers], Ward, District and National/Zonal levels)

SMMRP BASELINE SURVEY

Focus Group Discussions:

Participants for the ASM Baseline study FGDs

- District Management Team in all Districts under study;
- Community leaders and representatives in all study areas;
- Artisanal and Small-scale miners;
- Mineral Traders (Brokers, Dealers, Buyers);
- Women, Children;
- Security (police offices);
- Health facilities (District Health Personnel).

SMMRP BASELINE SURVEY

Observations:

- Characteristics of ASM operations (area, mining processes, fabrication, ASM-related services);
- Techniques and technologies employed;
- Financial and Marketing transactions;
- Participation and nature of participation in ASM.

SMMRP BASELINE SURVEY

Participatory Methods	
Method	Description
Stakeholder analysis	Identification of who has a stake in ASM per mining community. This is necessary for primary sampling of individuals
Institutional analysis	used to understand, from an insider's perspective (e.g. Miners, buyers, etc), how resources (minerals) are currently managed and, to determine the best way to manage local resources (e.g. minerals) based on a sound knowledge of current ASM local management regimes.
Gender-resource mapping	Delineating ASM activities and processes by gender (ownership, access, position).

SMMRP BASELINE SURVEY

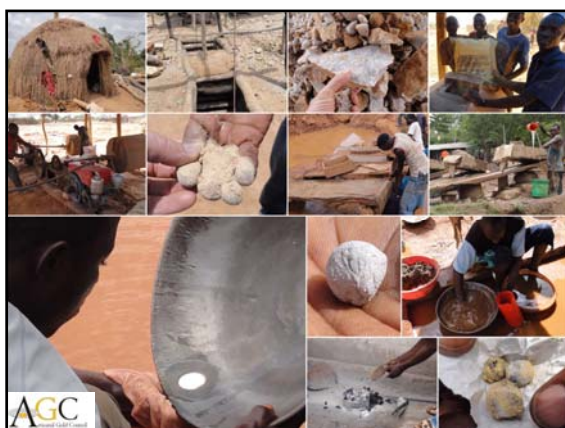
Development of an MIS-based database:

- To be based on extension of existing Mining Cadastral Information Management Systems (MCIMS);
- Will be attained by identifying relevant ASM objects, actions and rules for programming using the FlexiCadastral Graphical User Interface tools;
- Data collection questionnaires tailored to the needs for importing data collected from the baseline survey into the MCIMS;
- Data mapped into corresponding MCIMS/FlexiCadastral Objects and for each desired database object/entity attribute fields that conform to the Relational database technology specifications.



Overall Strategy

- Transition towards formalization (legality) and away from mercury use
 - Avoiding black market
- More organisation and better practices and more profits
- Needs to be facilitated by government policy and services



Improvements – Exploration

- Improved Exploration
 - Drilling
 - Geophysics
 - Small scale cheap exploration services
- Why?
 - Safety
 - Less environmental impact
 - Efficient exploitation
 - Relationship building
 - Communication



Improvements - Mining

- Mining
 - Winching – pedal hoists
 - Ladders
 - Timbering
 - Organisation
 - Etc.
- Potential role of development programs
 - Technology + Better Practices (Environment) + training + microfinance + higher profits



Ghanaian Legal Cooperative



Improvements - Processing

- Easy
 - Sluicing – better carpets; zig-zag design; laminar flow
 - Better concentrates
 - Require less mercury
 - Can be **directly smelted** (zero mercury)
 - Ghana example
 - Use less mercury – currently overused
 - Reactivation for more gold and less mercury
 - Fume hoods + retorts





Ghanaian Direct Smelting ASM Furnace

- 20 minutes
- Works on concentrates
- Gets un-liberated gold – more than mercury
- \$600
- Credit: Mining University, Prof. Sadegh Al-Hassan

Improvements - Processing

- More Sophisticated
 - Crushing + grinding (ball mill improvement, saves money)
 - Centrifuges and other concentration proc.
 - Tailings sales + re-processing (assaying, fair value)
 - Cyanide (international code barrier) + new innovations
 - Other leaching technologies



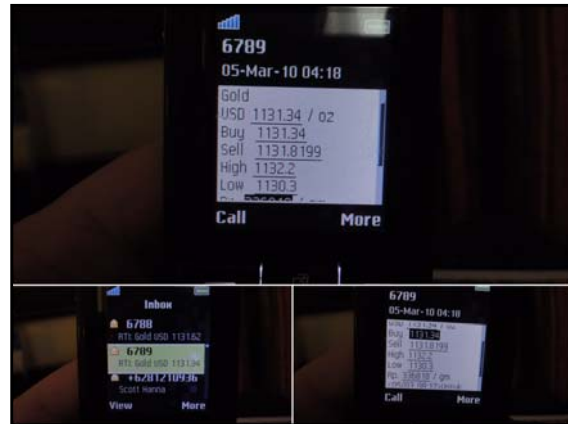
Improvements – Waste Management

- Little is being done currently
- Improvements
 - Lined amalgamation pits
 - Lined tailings dumps (want to preserve value)



Improvements – Sales and Trade

- Telecom system
- Broadcast gold price for better margin for miners – keeps capital local + reduces black market
- Establishes communication – can be two way system
- Flow of gold needs to be through Tanzanian official channels – so need to compete with any trader – Ghana, Philippines



Conclusion

- Potential role of development programs
 - Technology + Better Practices (Environment) + training + microfinance + higher profits
- Many opportunities for simple innovations to improve livelihoods and reduce mercury
- www.mercurywatch.org Tanzania – 45 tonnes
- Thank you!

Reducing Mercury Exposures and Transitioning Miners Away From Mercury Use



Haji Rehani
AGENDA for Environment and Responsible Development (AGENDA)

INTRODUCTION

- AGENDA implemented a project “Training of Trainers on Alternatives of Mercury and Best Available Techniques (BATs) and Best Environmental Practices (BEPs) in Artisanal and Small Scale Mining in Tanzania”
- Based on awareness raising on alternative technologies on recovering gold in central and lake zone by using Borax (Sodium Tetraborate)
- Similar project had been implemented in southern part of Tanzania by the Ministry of Energy and Minerals.

Introduction.....

The project is the outcome of:

- Study on Impact of Mercury Use by Artisanal Gold Miners in Tanzania, 2007; and
- National Mercury Forum, 2008 – organized a forum for different stakeholders in Tanzania;



Key Study Findings

- Borax seemed more expensive to use by local miners (Cost effectiveness i.e. mass and heating required comparing to mercury);



Key Study Findings.....

- Retorts not used by miners as they require more heat (economically viable for large amount of amalgam);



RECOMMENDATIONS FROM THE STUDY

- Alternative technologies should be thoroughly researched so that they will not turn out to be hazardous
- Explore locally available solution like the used of local equipments such as “Mkuba” for heating which is efficient and affordable as well as it can achieve to heat the materials to high temperature with locally available resources i.e charcoal;
- More awareness raising on alternatives is needed to miners

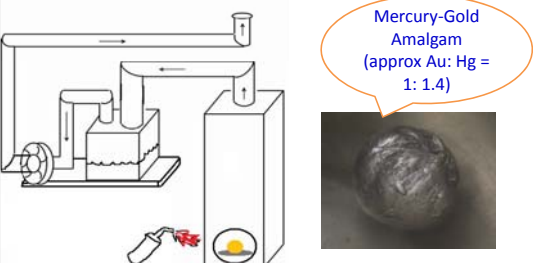


HOW TO REDUCE MERCURY EXPOSURES

- Facilitate and support miners to form groups that can employ medium scale technologies (e.g. Cyanide)
- Reduce illegal mining by re-licensing to ASGM those large scale mining licences that are not developed for more than 20 years (e.g. STAMICO licensed areas such as Tembo Mine-Geita);

HOW TO REDUCE MERCURY EXPOSURE.....

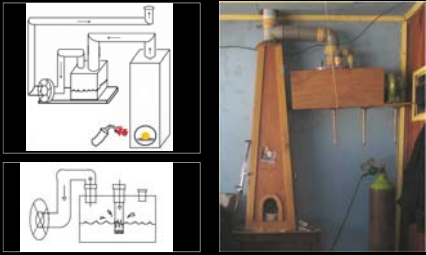
- Minimising mercury release on the environment and exposure risks by encourage brokers install fume hood and encourage miners to burn their amalgam at brokers place



Mercury-Gold Amalgam
(approx Au: Hg = 1: 1.4)

HOW TO REDUCE MERCURY EXPOSURE.....

The Water Trap Condenser

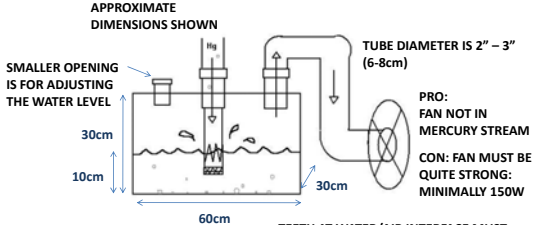


The design arose from the UNIDO Global Mercury Project, implemented in Kalimantan with the help of Yayasan Tambuhak Sinta (YTS), and direct involvement of local operators (Courtesy of Artisanal Gold Council)

HOW TO REDUCE MERCURY EXPOSURE.....

THE TUPPERWARE FUMEHOOD operating in "air sucking mode" - detail

APPROXIMATE DIMENSIONS SHOWN



SMALLER OPENING IS FOR ADJUSTING THE WATER LEVEL

30cm

10cm

60cm

TUBE DIAMETER IS 2" - 3" (6-8cm)

PRO: FAN NOT IN MERCURY STREAM

CON: FAN MUST BE QUITE STRONG: MINIMALLY 150W

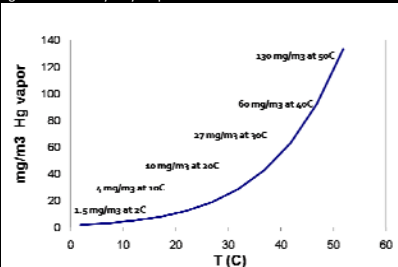
CLEAR PLASTIC TUPPERWARE IS USED FOR BOX; LID MUST BE WELL SEALED. WIRE MESH IS USED AROUND TEETH (MESH SHOWN BELOW TEETH IN PICTURE) TO INCREASE BUBBLING.

TEETH AT WATER/AIR INTERFACE MUST ALLOW SOME AIR THROUGH. FUMEHOODS IN KALIMANTAN ARE RUNNING SUCCESSFULLY IN THIS MODE; FANS ARE 150W (1Amp) or 260W (1.6Amp). URLs FOR ELECTRIC BLOWER FAN DISTRIBUTORS ON SLIDE #5.

HOW TO REDUCE MERCURY EXPOSURE.....

Empirical "Hg vapor phase in air" saturation equilibrium data
Recall 1mg = 1,000,000ng = 0.001grams.

This relationship implies that in a gold shop 6m x 8m x 3m (150m³) at 30C, 3.9 grams of diffuse elemental mercury (vapor) is present if equilibrium is reached with available mercury. At 40C, 8.6 grams of mercury may be present.



Temperature (T) in C	Hg vapor concentration (mg/m ³)
2	1.5
10	4
20	10
30	27
40	60
50	130

HOW TO REDUCE MERCURY EXPOSURE.....

Testing the Water-Trap Condenser



HOW TO REDUCE MERCURY EXPOSURE.....

- Capable of capturing at least 62% of mercury emitted from burning amalgam (gold shop trials suggest more like 75% capture)
- A busy gold shop can recover up to 1kg of mercury per month
- Potential to prevent the release of at least 5 tons of mercury to the atmosphere on an annual basis
- More attention is needed to spread this and other mercury recovery technologies to ASGM



Thanks for your attention

EXPERIENCES IN THE IMPLEMENTATION OF THE GLOBAL MERCURY PROJECT IN TANZANIA

Aloyce L. Tesha – Principal Geologist; Ministry Spokesman
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Structure of Presentation

- ▣ Background
- ▣ Socio economic study
- ▣ Environmental assessment
- ▣ Health assessment
- ▣ Legal review
- ▣ Micro-credit study
- ▣ Training of trainers
- ▣ Transportable demonstrations – success indicators
- ▣ Challenges

Background

- ▣ The Global Mercury Project (GMP) was an initiative sponsored by GEF, UNIDO and UNDP in collaboration with the Government of Tanzania for the removal of barriers to the introduction of cleaner technologies in artisanal and small-scale gold mining.
- ▣ Project site: Geita District specifically –Rwamagasa, Nyarugusu, Nyakagwe and Mgusu mining centres.
- ▣ The project starts in 2002 end second half of 2007.

Experience from the Socio-economic Study

- ▣ 250 respondents from the Rwamagasa Mining Centre participated in the survey.
- ▣ The Mining Centre has a population of 26,990; has 5,017 households average size of 5.4 people.
- ▣ The population relies on mining in conjunction with livestock, small business, farming and fishing.
- ▣ **Conclusion of the study:** most ASM in the Centre do not own claims; few miners know the effects of mercury; most are willing to learn the new technology; and are not members of mining associations.

Environmental Assessment

- ▣ High levels of mercury occur in historic tailings piles (mean 5 mg/kg) and sluice box tailings (mean 3 mg/kg);
- ▣ High concentrations of Hg in drainage sediments and soils due to mineral processing waste and mercury vapour;
- ▣ Hg in vegetable and grains samples are below the detection limit of 0.004 mg/kg; and
- ▣ Fish tissue data indicate that the sites sampled in the immediate area of mining activities at Rwamagasa are the worst affected and is a sites for bio-methylation.

Crop samples from an area impacted by overflow water from an amalgamation pond



Sampling of onions being cultivated at a site North of river single and irrigated with contaminated stream water



Health Assessment

- ▣ The primary result mercury is a serious health hazard in the mining area of Rwamagasa;
- ▣ Miners working for many years in the amalgamation or smelting process showed severe symptoms of mercury intoxication; and
- ▣ The exposure of the whole community to mercury is reflected in raised mercury levels in the urine, and first symptoms of brain damage like ataxia, tremor and movement disorders.

Breast milk

- ▣ Two mothers had a clinical intoxication
- ▣ MeHg hair levels were below 5 $\mu\text{g/g}$, which is below limits that were considered "safe"
- ▣ But total Hg in hair was very high
- ▣ Hg in breast milk was so high, that US-EPA standards (RDA) were 25 to 75 times exceeded!



Outcome of the Legal Review study

- ▣ The recommendations of the GMP on legal review on ASM form an important input to the current **Mineral Policy of 2009** and its subsequent legislation **The Mining Act 2010**.
- ▣ The inputs are reflected in **THE MINING (ENVIRONMENTAL PROTECTION FOR SMALL SCALE MINING) REGULATIONS, 2010**

Micro credit study

- ▣ ASM to get micro-credits it is important to form savings and credit cooperative societies.
- ▣ Some examples of such societies within the small-scale mining communities are operational.
- ▣ Various micro lending institutions indicated willing to venture in the sector but they require training to understand the sector.

Training of Trainers

- Health providers from Geita district hospital and from health centres near ASM centres in the district as well as mines officers were trained to diagnose Hg intoxication in 2004.
- Second training in 2006 include the first trained group together with village leaders, local government officials and miners to prepare for the TDU.
- Third training was before the launching of the TDU in 2007.

Trained health providers of Geita District



Health Trainers practising how to diagnose mercury intoxication



Second training the trainer in 2006



Trainer practicing how to train others



Simple technology was demonstrated



Third training the trainer group picture



Trainers in Class third training



Trainers training others



Transportable Demonstration Unit (TDU)

- ▣ TDU contain a selection of cleaner gold processing options using simple equipment and educational materials;
- ▣ TDU was assembled and introduced to the project's target mining communities; and
- ▣ TDU provide a multi-purpose forum for community demonstrations and training.

Launching TDU



Success indicators for the awareness campaign using TDU

- ▣ Recovery of Mercury by using retorts;
- ▣ Increased awareness among youth and community demands for policing.;
- ▣ Agreement by local leaders to train other fabricators on making retorts locally; and
- ▣ The Community has allocated land to be used for washing ponds away from water bodies.

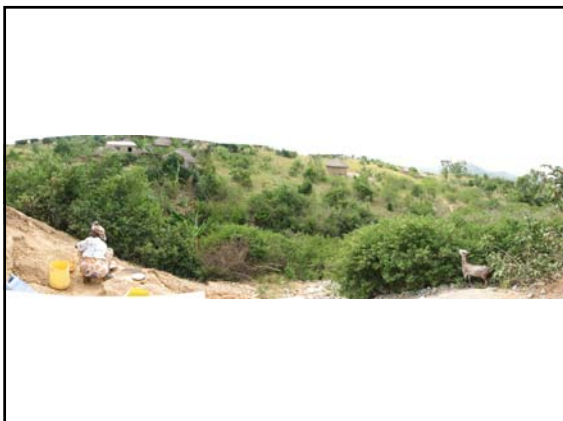


- Continue: Success indicators for the awareness campaign using TDU**
- ▣ Mandatory training for polluters and use of retorts;
 - ▣ Construction of walls to control tailings spillage;
 - ▣ Improved ventilation and use of safety gear;
 - ▣ Enforcement of local regulations around safe practices;
 - ▣ Medical counseling and mercury testing;
 - ▣ Better health from improved sanitation and hygiene;
 - ▣ Participation of local leadership in monitoring activities;
 - ▣ Local Capacity Building; and
 - ▣ Investment in better technology by miners.



- Challenges**
- ▣ Conduct a baseline survey to assess the impacts of the Awareness Campaign and training activities.
 - ▣ Conduct meetings with stakeholders to discuss other indicators of behavior change and identify needs and concerns that remain problematic to community members.
 - ▣ Provide support for local leaders to continue to provide training and reinforce safe practices.
 - ▣ Encourage government, through district authorities, to provide incentives to village leaders involved in the behavior change monitoring activities

- Challenges Cont.**
- ▣ Village Councils should have sufficient power to prosecute repeat polluters who do not want to adhere to environmental regulations;
 - ▣ Sufficient budget allocation to Geita Resident Mines office is necessary to sustain extension services, inspections and TDU activities; and
 - ▣ Entrepreneurship training and credit facilities to disadvantaged groups are necessary to address the exploitative practices of most gold brokers and washing pond owners.



•Esther earns 8-16 \$ per month for a 10 hour day, 7 days a week

• She lets her children tend the fire that boils off the mercury while she cooks the family dinner

• She claims not to know of the dangers of mercury but she would not look me in the eye when she said that

• Esther cares but has no choice

• She lives in terrible conditions in a brutal society where women suffer more than anywhere I have ever seen

•Esther is a “Conscript of Environmental Destruction”

National Strategy for Growth and Reduction of Poverty (NSGRP)
MKUKUTA June 2005



Artisanal and small-scale mining is increasingly becoming dynamic as it provides alternative economic opportunities to the rural communities. There is need to balance the livelihood requirement of artisanal miners with the economic objectives of the large-scale operators. Currently, backward and forward linkages are not strong enough for local value-addition and employment creation. Serious poverty concerns have been raised regarding the impacts on environment, tensions over land rights and labour relations in areas where mining activities are being undertaken. The challenge ahead is to ensure that investments benefit the wider economy by giving particular attention to disadvantaged regions.

- Develop a system to ensure safe and sustainable small scale mining; and at least 90% of registered small scale miners trained in safety awareness by 2010
- Safety awareness campaigns in the mines and monitoring visits of prospecting and mining activities

© 2005 – ASM Meeting, North Mara Mine, 10/06/07



Speech by H.E. Jakaya Mrisho Kikwete
Indaba, February 2007



.....The other thing is related to artisanal mining. Artisanal mining is a reality that we all have to face. Most of these are young, self-employed people trying to survive. For example, it is worth noting that Tanzania has over one million artisanal and small-scale miners, most of them are involved in gold and gemstone mining. They lack in skills and lucrative market where they can get a fair return for their sweat and toil. You can help. We together can do something to help them.

We in Tanzania would gratefully welcome technical and financial assistance from large scale mining companies with the aim of transforming this sub-sector into a modern undertaking. You can provide small-scale miners with technical skills, technology, capital and a reliable market for their stones.....

© 2005 – ASM Meeting, North Mara Mine, 10/06/07

Value Chain

- Artisanals extract gold in the most dangerous conditions, they discard lower tenure gold bearing ore as waste and receive minimum payment
- “Investors” and “Owners” take the lions share of the value from the miners
- A large number of people, mainly women are then involved in crushing, drying and mixing of the crushed product with Hg
- Sale of gold in amalgam or “pure” form closely tracks spot prices
- So the value is taken or lost in the mining, crushing and recovery steps
- The people who do the work and take the risk don’t get the rewards

What is clear is there are large amounts of value already in ASSM

There is greater value to be added through applying better methods without increasing mining volume

The people who are most affected get the least value and have the greatest environmental effect

Tanzania has a resource of 90 million ounces

Some 30 million ounces are contained in the reserves of ABG and AGA

The rest is waiting to be exploited or is being exploited by ASSM

Tanzania has a need for organised and legalised micro, small and medium scale mining

500 oz per month
 3000 oz per month
 10000 oz per month
 AGA 30-60000 oz per month
 ABG 70-90000 oz per month

Hg and how to deal with it

Existing Hg contamination

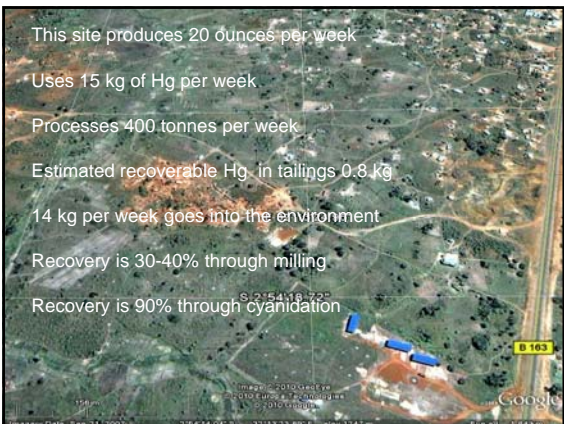
Recover by retreatment of tailings
 Identify sources of Hg
 DiaGeo?

Future Hg contamination

Remove Hg through all possible alternative processes

Testwork on Artisanal Tailings (Geita)

Leach	Mercury in Solids (ppm)	Mercury in Solution (ppm)
Stockpiled "OLD" Tailings	2.3	n/a
Direct Cyanidation	2.1	0.08
CIL + O2	1.9	<0.01
RIL - O2	1.9	<0.01
RIL + O2	2.1	<0.01



The best approach is to commercialise the artisanal process rather than try and "aid" it

If the solution has commercial viability then it will succeed

Success at a micro scale will naturally breed small scale and medium scale entrepreneurs

Only a co-operation between Government, an all inclusive ASSM community, civil society and mining companies/entrepreneurs will succeed

Principles
No Child labour
No hard labour for women
Minimum safety, health and environmental standards
Education
Standards
Legalisation
Access to capital
Share benefits

Comparison between Raminex and traditional large mining companies in Tanzania		
	Large scale	Raminex
Means of production	High tech minimal labour	Low tech, significant manual labour
Capex	High	Low
Payback	Medium to long term	Short term
Life of mine	Medium to long term	Short, medium and long term
Ore body confidence	High	Low to medium
Production cost	Medium	Low
Discovery cost	High	Low
Upside on recovery	Minimal	High
Upside on volume	Minimal	High
Scope for growth	Medium	Very high
Government support	High	Very high
Community support	Low	Very high
Social development	Medium	High
Economic development	High	Medium
Social stability	Low	High
Effect on crime	Increases	Decreases
Effect on education	Low	High
Effect on environment	High	Medium
Social fabric	Damaging	Positive

Current focus
<ul style="list-style-type: none"> • Projects around lake Victoria goldfields • Communicate, organise and educate artisanal communities • Establish feasibility • Source funding • Focus on clean up of mercury contamination • Each project is specifically designed for each site • Most sites have paybacks of within 12 months
Challenges
<ul style="list-style-type: none"> • Legality for artisans • Logistics - Borax • Convincing people of reward vs traditional risk for investment

Small scale miners irked by delayed multibillion programme

Small scale miners have claimed that the multibillion project aimed at transforming artisanal mining into small scale mining in troubled Tarime gold's belt is proving to be another white elephant, just two years since the government embarked on the programme. The project initially introduced by African Barrick Gold in mid 2008 as one of the company's payback initiatives, whereby among other things, it agreed to invest about \$2.5 million, is facing major stumbling blocks at the Ministry of Minerals and Energy. But contacted by The Guardian on Sunday, the Minister for Minerals and energy, William Ngeleja, strongly denied claims that his ministry has purposely delayed the project, adding thousands of small scale miners to remain calm as the government finalise plans to supply them with modern equipments.

