

Global Mercury Project



The Global Mercury Project Past and Future



Kevin Telmer
 GEF/UNDP/UNIDO Global Mercury Project
 University of Victoria, Canada


Why is Mercury in ASM a Problem

- Severe occupational hazards – Mercury vapour
- **Neurological damage to people**
- **Decreased capacity for innovation and prosperity – societal regression**
- Tens of thousands of polluted sites with far reaching impacts
- Long-term environmental health hazards to populations and ecosystems
- Intense local food chain contamination - fish
- Intense local ecosystem damage
- Global food chain contamination
- Global ecosystem damage

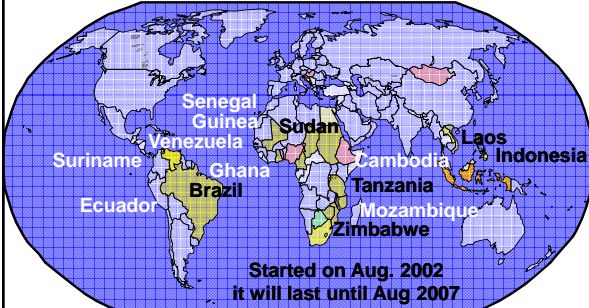
Global Perspective

- As a consequence of poor practices, 650 to 1000 tonnes of mercury per year are released
- 1/4 to 1/3 of all global anthropogenic releases
- ASM is the single largest intentional-use source of mercury pollution in the world
- Perhaps 100 million people indirectly involved and potentially directly exposed to mercury
- More if the global impact is considered – global contamination of fish

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In collaboration with UBC Dept of Mining Engineering



**Started on Aug. 2002
it will last until Aug 2007**

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Objectives

- ✓ Environmental, health & socio-economic evaluation
- ✓ Create policies to insert artisanal mining into the formal society; suggest legislations
- ✓ Education of miners and communities
- ✓ Improve gold recovery; building equipment
- ✓ Reduce mercury exposure and emission
- ✓ Evaluate mercury mobility in water streams

What is GEF/UNDP/UNIDO GMP?

- GMP Teaches, assesses, and innovates best practices in technical know-how and governance (local to international) to assist small scale miners move towards cleaner technologies, sustainable livelihoods, and better health
- Essentially it is a field operation (local communities) but with frequent visits to national and international governments and partners

GMP Perspective

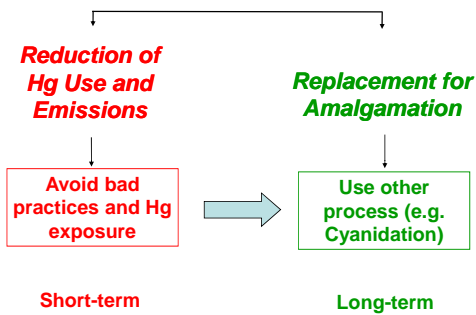
- Through bad practices, the miners frequently leave gold behind while polluting the world with mercury
- If we teach miners how to get a little more gold while reducing mercury use, the change **pays for itself**
- Being a good citizen also counts, but not as much
- In seeking solutions, we should not be asking small scale miners to take a pay cut – nor intentionally inducing one
- Lets not squeeze people to change but rather help them to change – empowerment!

Two Phase Approach

Two phase approach to capacity building in technical know-how and governance.
Financial incentives are the core motivational force

- Less Mercury, **More Gold**, Better Health
- Zero Mercury, **More Profits**, Community Development

Solutions Being Introduced



Education

- Education is Everything
- It goes both ways
- Understanding what miners do and why is critical to promoting change



Brazil, 2006



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Education/Training is not Trivial

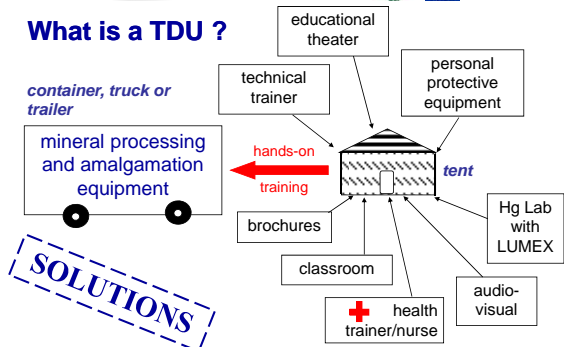
- Miners cannot afford to stop their activities to “be educated”
- Miners learn by example
- Miners must decide what is good for themselves...not us
- Miners move from one site to another
- GMP innovation: **Transportable Demonstration Units**




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What is a TDU ?




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TDUs Have Different Shapes in Different Sites



Indonesia, 2006



Sudan, 2004

Training the Trainers



Sudan, 2006



Tanzania, 2004



Brazil, 2005

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Success of the Train-the-Trainer Model





The GMP Team trained local miners on the use of retorts to reduce Hg exposure...

...later in the day, the local workers were teaching others in the community.

Demonstrating Availability of Gold Concentrators






Zig-zag Sluice



Indonesia, 2006



Laos, 2006

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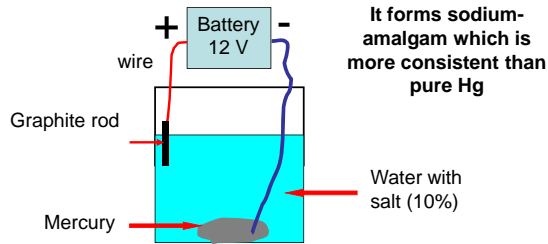


- Working with Industry to develop ASM technology
- ASM Centrifuge
- Price <US\$4000
- 1-2 tonnes/h
- Good for fine gold



Falcon Concentrators Canada, 2006

**Activating Hg before amalgamation
(increase coalescence = reduces Hg
flouring = less Hg loss with tailing)**

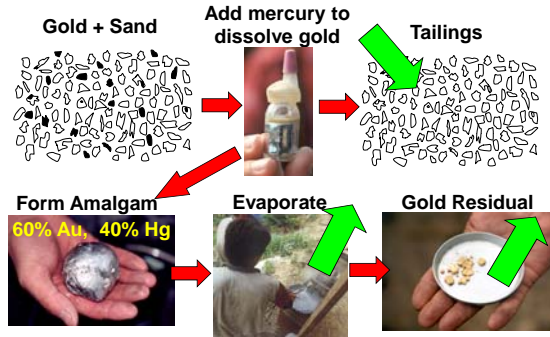


Brazil, 2006



Zimbabwe, 2006

Understanding Processing to Find Solutions

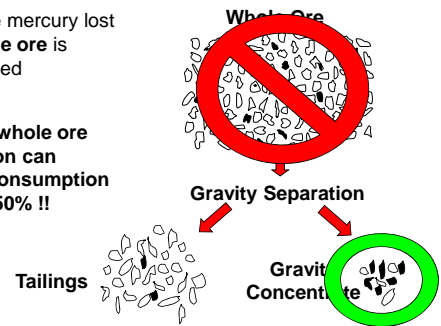


Mercury Losses Vary With Style Of Operation

- Much more mercury lost when **whole ore** is amalgamated

Eliminating whole ore amalgamation can reduce Hg consumption globally by 50% !!

A GMP Focus!



Preparing to Amalgamate The Whole Ore



Photo K. Telmer, 2006

Amalgamating the Whole Ore



Photo K. Telmer, 2006

Capturing the Mercury Rich Slurry



Photo K. Telmer, 2006

- 60-70% of gold remains in slurry
- 20 to 50g mercury per gram of gold is lost to the slurry

As high as 20:1 or even 50:1

Cyanide Use After Mercury!



Gold adsorbed on carbon is recovered by burning, mercury emitted to atmosphere



- adsorbed gold and lots of adsorbed mercury!
- Carbon is burnt releasing mercury and leaving the gold as a residual ash
- Sometimes the ash is amalgamated again with mercury

Slurry Disposal



Sky High in Cyanide and Mercury!



Cyano-Mercury Complexes Released into Environment

- Enhanced Transport
- Enhanced Bio-Availability



Photo K. Telmer, 2006

Why is this done?

- Miners know they will get all the gold with just Cyanide
- So Why use Mercury at all?
- When capital is needed quickly (subsistence)
 - Sophisticated processing takes too long
 - 1 or 2 months is too long
 - Can you wait more than a month to be paid?
 - Without a credit card?
- Simple profit sharing mechanism between owners and labourers

GMP Solution: Moving Upstream - Using Cyanide in the Grinding Circuit (Replacing Hg)



200 kg of gold ore in ball mills with 0.5 g/L NaCN

Carpet or centrifuge to trap coarse gold after cyanidation

Photo R. Baker, 2006

Indonesia, 2006

Tailings Handling and Disposal

- Excavated pool lined with a plastic trap
- When the pool is full, cover it
- CONTAMINATED TAILINGS MUST NOT BE RECYCLED



Brazil, 2006



Tailings Should not be Disposed into Rivers

- Tailings in a dams, far away from rivers
- Use straw, to make a filter to recirculate water



Brazil, 2007

When the Tailing Dam is Full...Revegetate it

- Tailing dam revegetated with "neem", mahogany, fruit trees, etc



Brazil, 2006



Problems with Hg vapor



Miner burning amalgam in an open pan
Hg vapor exposure of the whole family

Cambodia, 2006
Photo: Tom Murphy

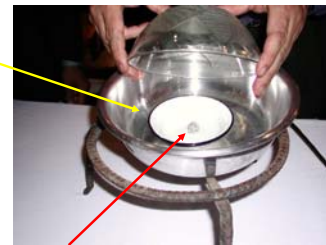


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Home-made Retort Using Kitchen Bowls

wet sand is added to seal



Lao PDR, 2003

Gold comes yellow as amalgam has contact with enameled dish

Kitchen-Bowl Retort

Sealed with wet sand

Ecuador, 2004

When gold is melted, residual Hg is released in populated environments

Instead of this...

Indonesia, 2003

Reducing Emissions from Gold Shops

20 gold shops in Galangan already adopted the new fume hood

>98% of Hg abatement

Indonesia, Kalimantan, 2006

GMP activities to reduce mercury consumption

1. Technology intervention
 - Use of filtered fume hood, condenser unit, and retort to burn amalgam.
 - Use Hg more efficiently.
 - Optimize sluice box process by refining design and choosing good material components.

Global Mercury Project | Budi Susilorini, GTFM, GMP, Vienna, 2007

Fume Hood Developed and installed by US EPA

Brazil, 2007

December 2006
MI&T Gold Shop Mercury Collection Equipment

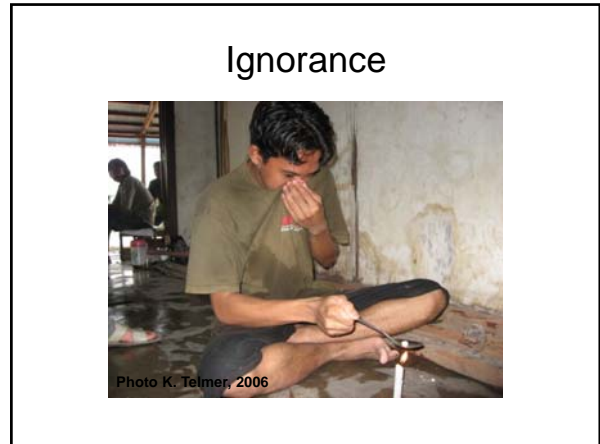
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Argonne

Reducing %Hg in amalgam from 40% (manual squeeze) to 20% (centrifuge)

Indonesia, 2001

Argonne



GMP Activity: Awareness Campaigns

2. Awareness campaign

- Primary target and secondary target
- Saturation style media campaign : billboards, posters, flyers, stickers, broadcast media, and UNIDO booklets
- Direct consultation
- Film screening

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Budi Susilorini, GTFM, GMP, Vienna, 2007

Awareness Campaign Focused on Groups at Risk

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Less Mercury, More Children Better Health

Laos, 2006

ໂລກກຸ່ມກຸ່ມນັ້ນ ການນຳໃຊ້ອັນຍາ ສູງຕໍ່ໂລກ

ການນຳໃຊ້ອັນຍາ ສູງຕໍ່ໂລກ ຈຶ່ງເຮັດໃຫ້ ສາມາດຮັບໄດ້ ທີ່ສຳຄັນ

GEF UNDP-UNIDO
Lao PDR

ປຶກຍາກ່ຽວກັບຄິດຂອງທ່ານ

- ສາມາດຫຼຸດລຸ່ມມັນໄດ້ ສາມາດປັບປຸງຄວາມ ສຳຄັນ ໂດຍສະເພາະ ແມ່ນຳໃຊ້ໃນຄອບຄົວ ແລະ ໃຕ້ກຸ່ມອື່ນ
- ໃຫ້ຊີ້ບອກເຮັດໃຫ້ຄວາມ ສຳຄັນຂອງມັນໃຫ້ກຸ່ມ ທີ່ສຳຄັນ
- ສາມາດຮຽນຮູ້ເຊັ່ນນີ້ໄດ້

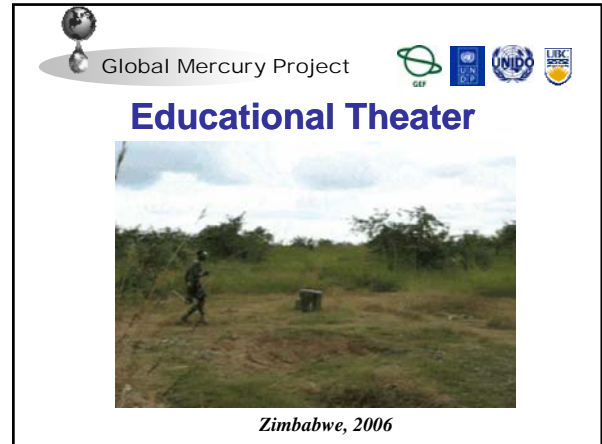
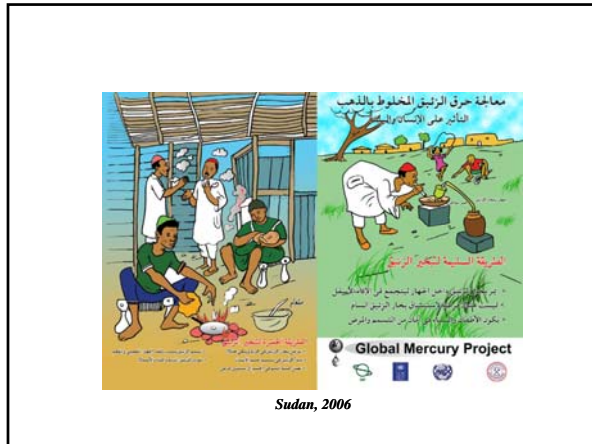
Indonesia, 2006

MERKURI DI TOKO-TOKO EMAS

LINDUNGI MASA DEPAN ANAK-ANAK ANDA

Setelah merkuri, lebih banyak emas dan lebih sehat

Sehat mental, lebih banyak emas dan lebih sehat



- ### Measured Success e.g. Kalimantan, Indonesia
- Increased awareness of mercury hazard
 - Public 41 to 83%
 - Gold Shop Owners 83% to 100%
 - Women 14% to 91%
 - Miners 21% to 93%
 - Reduced Mercury Consumption
 - 17 out of 35 gold shops have installed the water condenser fume hood to capture and recycle mercury
 - Up to 2 tons of Mercury Emissions Eliminated
 - Exposures Greatly Reduced
 - Formal Relationships with miners and Governments and NGOs were formed

-
- ### Policy
- International Guidelines on Hg Management
 - National & International Mercury Trade
 - Capacity-building within Governments
 - Micro-credit Initiatives
 - ASM Cooperative Organization
 - Fair Trade Gold

Banning copper-amalgamating plates

Suggesting this into the legislations of the GMP countries

Brazil, 2003

Trade: Mercury is Export and Import

- Mercury is readily available in most countries
- Enters developing countries legally, often for dental use
- The majority ends up being used in ASM

Zimbabwe, 2005

Is it Possible to Limit Supply Locally?

- Almost no success across ASM sector over 30 years
- Stringent policy sounds good but drives it underground and out of reach
- Regulating imports is more difficult than regulating exports from developed countries
- Export bans from main sources will be easier and more effectively control mercury trade
- EU by 2011, Perhaps the US too.

Determined Mercury Conservation



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Impact of Increased Mercury Price

- A ban on mercury trade by big traders will stimulate mercury conservation at ASM operations

Ethics

- Increased costs are passed on to the poorest
- Export bans represent a unilateral action which can impoverish or further indenture the poor
- An export ban therefore needs to be accompanied by the development and implementation of viable replacement technologies or replacement economies for small scale miners
- Don't squeeze people to change but rather help them to change
- Field based intervention programs like GMP must remain a priority

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Indications of Success

- About 30,000 miners trained in all 6 countries
- About 120 Govt people trained
- About 75 interviews in newspapers, radio and TV in all project countries + US (Chicago Tribune, New York Times, Wall Street Journal, etc) and Canada (Globe and Mail, Global News, Northern Miner, CBC, UBC Reports, etc.)
- Publications: 9 in int. journals, 3 chapters in books, 2 books, 37 in conference proceedings, 35 reports, 4 MASc thesis; 6 PhD thesis (5 in preparation)

Institutions Subcontracted

BGS (UK)
BRGM (France)
CETEM, Instituto Evandro Chagas, IBRAD (Brazil)
Earth Systems (Lao PDR)
GRAS (Sudan)
Inst Mining Research (Zimbabwe)
Smith-Nagal Foundation (Ecuador)
Tan Discovery (Tanzania)
Univ. Montpellier (France)
Univ. Munich (Germany)
YTS, Lestari, Friends of the National Park Foundation (Indonesia)

**Collaboration with Universities,
NGOs, companies, agencies**

Belgium: European Environmental Bureau
Canada: Univ. British Columbia, NSERC, Falcon Concentrators,
Canadian International Development Agency
Germany: Univ. Aachen, Univ. Bremen
Indonesia: Univ. Sam Ratulangi
Sudan: Practical Action
Tanzania: AngloGold Ashanti
UK: DFID
USA : US EPA, Blacksmith Institute, Natural Resources Defence
Council, Zero Mercury Campaign
Zimbabwe: Amakhosi Theater Productions, Zimbabwe Panners
Association

Global Mercury Project 2

GMP – 2 Strategy

- Development of a three level intervention strategy
- Including 7 Main Objectives




Tanzania, 2001

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Objectives

1. Inventory
2. Policy
3. Health and the Environment
4. Training of the Trainers
5. Awareness Campaign
6. Technology Transfer
7. Sustainability Initiatives



Venezuela, 2003

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Budget/Activity Summary

Objective	Level 1 5 years	Level 2 1 year	Level 3 3 mon.
Inventory	✓	✓	✓
Policy	✓	✓	
Health and Environment	✓	✓	✓
Training of Trainers	✓	✓	✓
Awareness Campaign	✓	✓	✓
Technology Transfer	✓	✓	✓
Sustainability Initiatives	✓	✓	
TOTAL	2,273,560	696,080	149,725

Global Mercury Project 2

Current Status of Interest

Level 1 ★
Brazil, Colombia, Ecuador, and Mozambique

Level 2 ★
Indonesia, Mongolia, Sudan, Suriname, Tanzania, Uganda and Venezuela

Level 3 ★
Benin, Bolivia, Burkina Faso, Cambodia, Cameroon, Chile, China, Dominican Republic, Ghana, Guinea, Guyana, Honduras, Lao PDR, Liberia, Madagascar, Malaysia, Mali, Mexico, Nicaragua, Nigeria, Peru, Philippines, Senegal, Sierra-Leone, Togo, Zambia, and Zimbabwe.

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Implementation Strategy

Suggestions:

1. Develop and Partner with a Global Center for Artisanal Mining (GCAM)
2. GCAM can multiply in the GMP countries creating advanced campuses where equipment can be tested and miners trained in the field

Implementation Strategy

Advantages:

1. GCAM will have international ASM experts, and laboratories to test ores and develop equipment
2. GCAM has strong focus on technical, environmental, political and social issues in ASM
3. Miners and Government officers can earn an official degree (or diploma)
4. Support from National and International Governments and Agencies and Multinational Mining companies

UNEP Mercury Partnerships

The UNEP GC Decision 24 (2/2007) calls for strengthening of UNEP mercury partnerships.

Additionally, UNEP GC Decision 24/3 IV specifically references enhancing the artisanal and small scale gold mining partnership in paragraph 27 (c) and indicates UNIDO should act as the lead.

Role of Partners in 'UNEP Global Mercury Partnerships'

- The UNEP Mercury Program welcomes all stakeholders to participate in the 'Global Mercury Partnerships'. A partner is any entity which expresses the willingness to contribute time, resources, or expertise to implement the objectives of the Partnership to achieve the mission of the 'Global Mercury Partnerships'. Participation in the Partnerships is voluntary, with new partners welcomed on an equal basis.

Conclusions

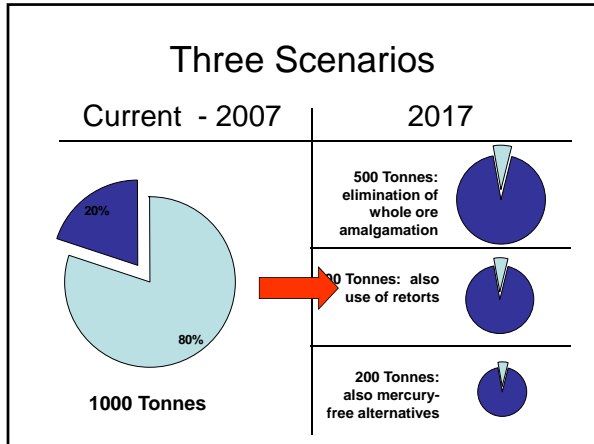
- Making Hg less available and less attractive
 - Trade Bans
 - Fair Trade Systems/Labeling
- Introducing Better Practices
 - no whole ore amalgamation
 - Cyanidation of Hg-contaminated tailings must STOP
 - Tailings with Hg must be properly disposed


Conclusions

- Providing an alternative
 - Alternative methods of small scale gold mining
 - Alternative economy – must not cause a pay cut to the poor
- Although mercury is a focus, successfully managing it is a strong indicator that many of the other issues like health and safety surrounding ASM are being addressed
 - Opportunity to address all MDGs





Mercury Reduction Goal – 50% in 10 years

- By eliminating whole ore amalgamation, improving practices, introducing market based incentives and supporting export bans, the GMP believes that a 50% reduction in mercury demand in small scale mining is attainable in 10 years time (by 2017)





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Thank you

- From the GMP Team, Partners, and Funders
- www.globalmercuryproject.org