



Global Mercury Project

Project EG/GLO/01/G34:

Removal of Barriers to Introduction of Cleaner Artisanal Gold Mining and Extraction Technologies



Final Country Report for Tanzania

November, 2007



Project EG/GLO/01/G34
Removal of Barriers to Introduction of Cleaner Artisanal Gold Mining and Extraction Technologies

Final Country Report for Tanzania

Global Mercury Project, Coordination Unit, Vienna

Pablo Huidobro, Project Manager, UNIDO
Marcello M. Veiga, Chief Technical Advisor, UNIDO
Svitlana Bogoslavskaya, Administrative Assistant, UNIDO

Primary Authors

Jemma Scoble, Project Coordinator Tanzania
Rogers Sezinga, Tan Discovery Consultancy Limited
Aloyce Tesha, Assistant Country Focal Point Tanzania

Disclaimer: *The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.*

Mention of company names and commercial products does not imply the endorsement of UNIDO.

©Copyright UNIDO, 2007

Table of Contents

Acknowledgement	3
Executive Summary	4
I. Introduction	5
II. The Global Mercury Project: An Overview	5
III. A Summary of Global Mercury Project Activities in Tanzania	5
IV. Artisanal and Small Scale Mining in Tanzania	6
V. GMP Areas of Interest in Tanzania	7
VI. Awareness Campaign: Objectives, Structure and Roles	8
VII. Awareness Campaign Materials	11
VIII. Implementation of the Awareness Campaign in Lwamagasa	13
IX. Implementation of the Awareness Campaign in Nyarugusu	14
X. Indicators of Success: Projects Impacts and Behaviour Change	16
XI. Challenges	17
XII. Conclusions and Recommendations	18
Table 1: Project Team and Roles	9
Figure 1: Blue Reef Small Scale Gold Mine	10
Figure 2: TDU with Project Poster	11
Figure 3: Lwamagasa Village	12
Figure 4: Villager presenting the benefits of using a retort	13
Figure 5: Training Site at Lwamagasa	14
Figure 6: Relocation of a washing pond away from the river channel	16
Figure 7: A locally fabricated retort	17

Acknowledgement

It takes a collaborative effort to successfully change behaviour in a community. Through their involvement in GMP activities, members of the communities of Lwamagasa, Geita, and Nyraugusu came together in a concerted effort to improve conditions within their communities. They brought hard work, creativity, dedication and commitment to GMP activities in Geita district. While striving to learn as much as possible in order to affect change, they shared their local expertise and knowledge in a way that added tremendous value to the project, to its approach and to the design of related materials. Our sincere gratitude is extended to all of the participants in the GMP activities in Tanzania – to the communities that embraced the project and to all of the people who gave their time, energy and resources to making the activities a success. Asante

Thank you to the local officials and government representatives who participated in this project. Their support was integral to our success and to ensuring long term benefits to their communities and the artisanal and small scale mining sector in Tanzania.

Role models and effective local leadership can have a powerful influence on their communities. The GMP activities in Lwamagasa could not have occurred without the involvement of a local business man and leader - Mr. Christopher Kadeo. Mr. Kadeo has is a true role model for his community and for the small scale and artisanal mining in Tanzania. He is proof that investing in miners and building on existing capacity can have remarkable results. We thank Mr. Kadeo for his generosity, for the use of his facilities, for sharing his own success story, for giving back to his community and for his commitment to change. Asante

The success of activities in Geita, Tanzania was only possible with the dedication, commitment and hard work of the GMP team members. These people have brought more than just their specific expertise in a variety of areas. They have demonstrated a commitment to the GMP objectives, country goals, and most importantly to the miners, their families and their communities. The successes listed in this report are testament to the hard work and talent of these people. Thank you to Mr. Aloyce Tesha, Mr. Rogers Sezinga, Mr. Halid XXXX, Ms. Patricia Scott, Ms. Georgina Cattaneo and to the many people involved in making the awareness campaign and training in Geita district such a success. Asante!

Thank you to the UNIDO team in Vienna, Vancouver and in the other participating countries for their support, ideas and hard work.

Special gratitude is extended to Marcello Veiga for his on going support and encouragement through planning to implementation. Mr. Veiga's expertise and insight has proven invaluable throughout this process and much of our success is due in part to his exceptional leadership.

Executive Summary

GMP Training and demonstration activities in Tanzania were undertaken by Tan Discovery Consultancy Limited and occurred over a five-month period. The first 2 ½ months (from 7th March to 16th May 2007) focused the project activities at Rwamagasa village. During the remaining two months and three weeks (from 18th May 2007 to 8th August 2007) the training activities were conducted at Nyarugusu village. During this period the project team maintained extension services at Rwamagasa village.

At Rwamagasa about 1430 villagers attended class training with an additional 2700 attending field demonstration activities. Training was also given to 522 pupils and 20 teachers from the two primary schools in the village. At Nyarugusu village about 3900 people attended class training courses and 4800 attended the field demonstration activities. Training was also provided to 1885 primary school children from Nyarugusu sub-villages. It is estimated that in the next six months another 5000 miners will be educated with the GMP materials.

The project team has observed numerous benefits resulting from the project. The following indicators of success were noted:

- About 98 retorts are now being used daily by artisanal miners and gold buyers in Rwamagasa and Nyarugusu villages. It has to be noted that most of the retorts are owned by gold buyers who purchase small amounts of gold from individual miners. A single retort is used by more than ten people daily. This is the first project in Tanzania to see miners are willingly using retorts to protect themselves against dangers of mercury vapor.
- Up to the end of October 2007, four local fabricators had made more than 230 retorts currently used by miners in Geita district. The fabricators now have additional income from the sale of retorts.
- Most of the mercury recovered by retorts, about 1kg per day, has been activated before re-use.
- Washing pond owners at Rwamagasa village purchased two water pumps, capable of supplying water to 20 washing ponds away from the water bodies. In the past most of the ponds were within the river channels.
- 15 washing ponds have been relocated away from water sources and far from the village.
- The village government of Rwamagasa has included mining and environmental issues as permanent agenda items in its council meetings. Most of the post project monitoring and follow-up is now been done by the village leaders such as prohibiting washing ponds in residential areas and prohibiting tailings discharge close to the water bodies. Before the project awareness campaigns this was considered to be the responsibility of the Mines Department which does not have sufficient staff to be stationed in all mining villages.
- A short survey at Rwamagasa village showed eight out of ten gold buying offices have modified their offices to improve air circulation and light. The village has more than 62 gold buyers - most of them small operators.

I. Introduction

This report aims to document the Global Mercury Project's Awareness Campaign and training in Geita District, Tanzania, during the period beginning in Jan 2006 and ending in August 2007. These activities included the preparation, implementation, monitoring and closure activities associated with the Awareness Campaign and the associated training program. The benefits of the activities and indicators of success are presented and the report concludes with a review of the achievements and challenges resulting from the activities. Recommendations for future initiatives are also provided.

II. The Global Mercury Project: An Overview

Environmental, health and social impacts resulting from the application of mercury in the processing of gold within the artisanal mining sector and their effects on international water bodies require a concerted and coordinated global strategy.

The Global Mercury Project (GMP) is an initiative sponsored by the Global Environment Facility (GEF), United Nations Development Organization (UNIDO) and United Nations Development Program (UNDP) for the removal of barriers to the introduction of cleaner technologies in artisanal and small-scale gold mining.

This will be enhanced through the introduction and demonstration of cleaner, more efficient technology and in improvements to miner's organization that, will improve earnings and production, improve health and safety for mining communities, facilitate access to micro-credit and micro-finance, and minimize environmental impacts.

The ultimate goals of the project are:

- 1) to reduce mercury pollution of international waters by emissions emanating from small-scale gold mining,
- 2) to introduce cleaner technologies for gold extraction and to train people in their application,
- 3) to develop capacity and regulatory mechanisms that will enable the sector to minimize mercury pollution,
- 4) to introduce environmental and health monitoring programmes,
- 5) to build capacity of local laboratories to assess the extent and impact of mercury pollution

In terms of broad development objectives, the GMP seeks to transform current ASM activities into organized activities to improve incomes, minimize negative environmental impacts, and enhance the development of the mineral sector and, consequently, the economy of participating countries.

III. A Summary of Global Mercury Project Activities in Tanzania

As part of the GMP strategic plan links between artisanal and small-scale gold mining and health, ecosystem and the social factors were examined between 2004 - 2006. Sociological, environmental and health assessments related to mercury released in project sites in Tanzania were also conducted during this period. In addition, the identification of appropriate technologies and practices to reduce or eliminate mercury emissions from these areas, as well as the building of capacity in local laboratories to assess the health and environmental impacts of regional mercury pollution on an ongoing basis were examined.

The next phase of the project was to implement a program of education and awareness amongst stakeholders and to introduce miners to a range of affordable mining and mineral processing technologies and practices. To this end Transportable Demonstration Units (TDUs) containing a selection of cleaner gold processing options and

educational materials were assembled and introduced to the project's target mining communities beginning. These TDUs provide a multi-purpose forum for community demonstrations and training.

Training is an essential component of the GMP activities in Tanzania, and the main means by which local capacity building can be achieved. Training has taken place in Geita, Lwamagasa and Nyarugusu, focusing on mercury pollution prevention measures, mine safety, mercury and health and technology transfer. In addition, GMP training in Tanzania included training in business skills, leadership and trust-building.

With behaviour change, capacity building and education as guiding principles of GMP activities in Tanzania, a training strategy was developed in an effort to ensure successful technology transfer, long term benefits to the community, improved health and leadership development. In 2006, a site specific study by Scoble and Bamber found that obstacles to successful technology transfer, improved organization, and collaboration and cooperation, were lack of business knowledge, lack of leadership and high levels of distrust. In response to these findings, supplemental modules were designed for the GMP training manual covering basic accounting, basic mine economics and operations management, and leadership, trust building and team building. These materials were tested and refined during a 2006 training session in Geita. In a more directed effort to address the problem of lack of organization among artisanal and small scale miners, a comprehensive study was conducted including a thorough assessment of existing conditions and organization, the development of a practical educational intervention to promote organization, focus group studies and fieldwork.

IV. Artisanal and Small Scale Mining in Tanzania

The Tanzanian mining industry has been dominated by gold mining for over one hundred years. The 1890's brought about organized prospecting and mining with discoveries being made in Geita, Kahama and Sekenke in the Lake Victoria Goldfields. Veiga notes that "there are 7 main regions at the south of Lake Victoria where gold miners have been operating" – these areas, referred to locally as "mining centres" were formed by the gold rushes that began in the early 1980s.

Over the last two decades, along with the price of gold, the number of artisanal and small-scale miners in Tanzania has been increasing. With close to one million Tanzanians depending on this sub-sector for their livelihood, poverty reduction efforts in rural areas recognize a huge potential in this area.

With such a significant segment of the population involved in ASM, mercury use a serious concern. In Tanzania, artisanal miners recover gold using mercury, with gold smelting or amalgam being burned in the open air, within the home or in processing areas. Miners use their bare hands when handling mercury – exposing themselves to risk both from vapour and from direct contact in liquid form. The estimated amount of mercury lost to gold produced is 1 to 1.5 and Hg lost (tones/a) is 0.003 to 0.06. In Rwamagasa, Geita District, 30kg of mercury is released into the environment every year and raised levels of mercury in urine samples from those living in area show mercury to be a serious hazard.

The mineral sector's GDP contribution has been increasing steadily, from 2.3% in 2000 to 2.5% in 2001 and 2.7% in 2002. The GDP contribution for 2004 stood at 3.5% and it is estimated that it will reach 10% by 2020 (Ministry Energy and Mines, Tanzania, 2006). The increase can mostly be attributed to gold exports, the value of which increased from \$121 million in 2000 to \$597 million in 2004. The total share of mineral exports for 2004 was 52%.

The significance of small-scale mining in Tanzania is evident in reports of the sub-sector employing an estimated 550,000 persons, 30-50% of which are women. Current estimates by the Ministry of Energy and Mines place the number of Tanzanians engaged in mining at over 1,000,000, more than 90 per cent of whom are engaged in the artisanal and small-scale mining sectors (Ministry Energy and Mines Tanzania, 2006). With the International Labour Organization estimating the number of artisanal and small scale mining workforce to be around 13 million in 1999, the Tanzanian workforce represents a significant percentage of the global total.

Operations in artisanal and small-scale gold mining areas in Tanzania, such as Nyarugusu and Mgusu, fall into the following categories:

Mineral rights owner manages the entire process (small-scale mining) – the payment system is: casual labourers paid in cash for determined task; mine workers are paid 30% of realized production; a percentage (35%) is divided between the manager, mine foreman, supervisors and guards; a percentage (15%) goes to the mine owner for the cost of operating the mine; and a percentage (50%) goes to the mine owner.

Mineral rights owner runs operations in a portion of the claim and leases out the rest to other operators (artisanal and small-scale mining) – key personnel obtain a share of production; casual workers are paid per task, operation of leased out pits (1-3) is determined by mineral rights owner, who receives a percentage from each pit (30%).

Organization occurs at pit level and the concession is leased to pit owners by mineral rights owner (artisanal mining) – a miner or group of miners obtains consent from the mineral rights owner to have a pit. Pit members work until signs of mineralized zones are detected. They either involve labourers to mine or bring in additional persons to the group. In the case of new members, founders of the pit benefit from an upgraded status whereby they supervise or supply tools rather than excavate. New members are given a specific task and receive a proportionate share in the endeavour. The standard percentage given to the mineral rights owner is 30% of production per pit.

Operation of processing facilities (grinding mills, sluices, manual crushing) – crushing and grinding by individuals working independently is followed by semi-processed ore being given to grinding mill operators. After someone has sluiced, an independent panner and amalgamator takes over.

Mineral brokers buy mineral commodities in mine sites, selling them to mineral smugglers or a city official dealer. In 1996 there were an estimated 700 illegal brokers in Tanzania. Mineral dealers are either licensed or unlicensed. They deal with gold and gemstones in mine centres (Drechsler, 2001). The Ministry of Energy and Minerals reported that in 1999 there were 5 licensed mineral dealers in Tanzania.

Secondary activities at mine sites can be categorized into two types of services: those that directly support mining and processing, and community services-oriented businesses that serve the mining community. The provision of mining equipment, fuel and transportation services and customs mills is a result of the former, the latter provides bars, restaurants, retail stores, pharmacies, food vendors, etc.

Deforestation and uncontrolled mercury use during amalgamation and discharge of tailings in or near water bodies are just two of the environmental impacts of artisanal and small scale mining activities in Tanzania. Related issues also include impacts on health and wellness, and on occupational health and safety.

V. GMP Sites of Interest in Tanzania

In Tanzania, ASM is most significant in the Lake Victoria Goldfields – specifically the Geita, Rwamagasa, Kahama, Musoma-Mara, Nzega and Kilimafedha belts – which produce more than 95% of the country's gold. Given the intensity of ASM, environmental and human health impacts from these activities are also most pronounced in this region.

Mwanza region is located in northern Tanzania next to Lake Victoria. Of the 35, 187 km area that constitutes the region, 43% is water. Mwanza is comprised of eight districts: Illemela, Nyamagana, Magu, Ukerewe, Geita, Sengerema, Kwimba and Misungwi. In 2002 the population of Mwanza was an estimated 2,942,148 persons, 712,195 of whom resided in Geita District (URT, 2003).

Most people involved in small-holder agriculture (85% of region's population) grow crops for the dual purposes of food and cash. There is a high dependence on cotton, fisheries exports and livestock keeping. With 108 cattle per sq km, Mwanza has 13% of Tanzania's total livestock. Mining and a booming fishing industry are credited with Mwanza's economic growth. Gold mining in Mwanza produced 5,777,523 gms in 2000 valued at TShs 42.2 billion.

Participation in economic activities varies in Mwanza region. In Mgusu, people are primarily dependent on mining, in Nyarugusu people engage in farming and ASM, whereas in other areas of Mwanza Region lives are sustained by managing a combination of activities among which are farming, fishing, small business and ASM – all key

components of the livelihood framework. In cases where ASM complements another income activity (such as in Nyarugusu), pits tend to be randomly located, close to homes or in the middle of a farming area.

Artisanal and small-scale miners in Mwanza region are primarily mining gold found in small deposits of high grade found in most shear and fracture zone structures and alluvial/elluvial deposits found within shallow lying sediments.

Located in the Mwanza region, the administrative district of Geita covers 7825km², 1050Km² of which is water – mostly Lake Victoria. Situated between between 2° 28'-3° 28' south and 32°-32° 45' east, on the shore of Lake Victoria, it is northeast of Sengerema District, northwest of Kagera Region, Southeast of Kwimba District and South of Shinyanga Region. Geita, has the largest numbers of miners than any other district and is comprised of four major ASM centres, namely Nyarugusu, Nyakagwe, Mgusu and Rwamagasa. In the Rwamagasa belt, gold mineralisation occurs in quartz veins as well as secondary enrichment in ironstone formations at the base of laterites overlying subsurface greenstone rocks.

In terms of administration, Geita is divided into seven divisions and twenty-seven wards with 163 villages. An all-season road, starting in Mwanza Town, provides access to Geita District. The road connects to the Biharamulo District of the Republic of Rwanda.

Geita District has the highest growth rate of all districts in Mwanza (3.6% from 1988-2002). This can be attributed to the influx of people brought in by increased ASM and large scale mining activities (Geita Gold Mine Ltd, 2005).

Geita District has over 15 artisanal and small-scale mining centres. The district experienced a boom during the 1980s and 1990s. Geita Hill and Ridge 8 are small areas that attract migrant miners. Geita District is believed to have the highest population of artisanal and small-scale miners in Tanzania. It is estimated that there are over 150,000 artisanal and small-scale miners in the district.

VI. Awareness Campaign: Objectives, Structure and Roles

As outlined in the Terms of Reference, the awareness campaign was designed with the objectives of improvement in gold recovery and reduction in mercury use and or loss, and enhanced awareness of the health risks of exposure to mercury. It was planned, coordinated and implemented by Tan Discovery Consultancy Limited contracted by UNIDO on December 29th, 2006.

There were two main components of the awareness campaign: health awareness and technology demonstrations. An outreach strategy was designed to ensure that the community and local leaders were actively involved in the project activities. An initial training workshop in May 2006 resulted in the successful training of over 25 trainers and provided an indication of specific areas for focus during the awareness campaign.

The project coordination centre was located in Dar es Salaam in close proximity to the UNIDO Resident Representative's Office. Madam Patricia Scott, the UNIDO Resident Representative, and Ms. Georgina Cattaneo, Program Officer, provided ongoing support during the preparation of promotional materials and the custom clearance of imported demonstration equipment. Project implementation, progress and reporting were also overseen by representatives at the UNIDO office Dar es Salaam.

Field activities were conducted in consultation with Assistant Country Focal Point, Mr. Aloyce Tesha who also represented the Commissioner for Mineral Resources for the project. Mr. Donald Mrema, Geita Resident Mines Officer, was responsible for the arranging official contact with Geita district officials. It was through these contacts that the GMP activities were linked to concurrent poverty reduction initiatives, and that the participation of local leadership, such as the District Commissioner, was ensured. Village chairpersons and village executive secretaries were responsible for promoting the training and technical demonstration activities – for encouraging the active involvement of members of their communities. They were also asked to participate in the Village Council Team that monitored work behaviour change of mineral operators, took administrative measures to support the behaviour change and addressed complaints from community members regarding unsafe use and exposure to mercury.

Table 1 Project Team & Roles

Project Team Member	Role
Mr. Rogers Sezinga	Team leader
Crispin Kinabo	Training & Technology Demonstration leader
Samwel Gombekile	Head Technician responsible for daily training and custody of the TDU
Mr. Eilas Kabadi	Assistant Technician
Mr. Kessy	Lumex Technician, Mwanza Water Lab
Dr. Simon Ngowi Dr. Daniel Izengo Mrs. Mwajuma Libuburu Mrs. Laurencia Mkungu Mrs. Rosemary Binamungu Mrs. Asila Rachid	Health Officer

Village leaders from Lwamagasa, Nyargusu, and Busolwa were involved in the awareness campaign. Among those participating were: Salvatory Mapalale (Chairperson Lwamagasa), Mpini Muhabwa (VEO Lwamagasa), Hamid Mgoi (Chairperson Nyarugusu), Binas Malekela (VEO Nyarugusu Centre), Philip Malindo (VEO Busolwa) and Sekile Muhagwa (Ward Executive Officer Nyarugusu).

Blue Reef Small Scale Gold Mine, Lwamagasa, was used as a primary location for a capacity building workshop and most of the demonstration activities. The mine is owned by Christopher Kadeo, a small scale miner who, with the assistance and mentorship of Tan Discovery, exemplifies the possibility for miners to improve safety and production. He has mechanized most of his mining and processing activities and the mine employs approximately 150 fulltime employees. Mr. Kadeo supported the GMP activities in Lwamagasa by providing use of his facilities, attending training sessions in 2006 and 2007, encouraging workers/community members to attend sessions, and sharing his success story with other participants. Field demonstrations and practical classes were conducted at Blue Reef Mine and included demonstrations on:

- Improving water management in mines – it was demonstrated that one small gasoline powered water pump is capable of serving more than ten washing ponds constructed more than 1000 meters from the water source.
- Using appropriate technologies – it was demonstrated that 20kg bag of milled ore was concentrated through traditional sluice box and another 20kg milled ore was passed to a sluice box with appropriate mats and well placed riffles. The good recovery of the modern sluice box convinced miners to consider using riffles in their sluice boxes.
- Conserving mercury usage – Miners also noted the strength of a retort over open fire burning of amalgam. Miners and gold brokers also learned how to charge mercury before reusing it.

Demonstrations activities at Blue-Reef mine and other processing centres at Lwamagasa village was attended by more than 2700 people.



Figure 1: Blue Reef Small Scale Gold Mine

VII. Awareness Campaign Materials

The Educational Booklets, tested during the 2006 training of trainers workshop in Geita, consisted of the following titles:

1. *Mercury and Health*
2. *How to Use and Re-use Mercury*
3. *How to Protect Your Water*
4. *How to Get More Gold*

These booklets were translated into Swahili and consideration was given to the local and regional terminology. They were printed by the UNIDO Resident's Office and 100 copies of each version were printed. Booklets were distributed to attendees at the TDU launch ceremonies and during class training sessions. The feedback from attendees was extremely positive and indicated that the design and content of the educational booklets was effective and useful for the target audience.

Four wall posters were designed for the awareness campaign. To remain consistent with the GMP objective of building local capacity and involving stakeholders in the design and content of materials, a local artist was commissioned to design the posters. 1000 of each poster was printed. Among the messages depicted are: unsafe mining practices pollute living areas and water bodies, mercury vapour is dangerous, mercury exposure protection, and measures to protect the environment.

Posters were distributed during the TDU launching ceremonies and training sessions. Copies were strategically placed in all public areas and mineral processing sites in Geita district.

T-shirts and caps (totaling 750 pieces) were also produced as part of the awareness campaign. These items showed the GMP logo with the caps reading the Swahili message “Mercury Kidogo, Dhahabu Zaidi” or “Less Mercury, More Gold”. The T-shirts had “jikinge na madhara ya mercury” or “protect yourself from dangers of mercury” across the back. These items were distributed the day before the TDU launches in Lwamagasa and Nyarugusu and were also distributed to stakeholders in Geita and Mwanza town.

As seen in figure 2, a large poster was produced with the GMP logo and the Swahili messages “get more gold by using less mercury” and “protect your environment and sustain good health”. The poster was affixed to the Transportable Demonstration Units and as background during the TDU classes.



Figure 2: TDU with project poster

Additional promotion consisted of project banners announcing the launching events that were posted in the villages of Katoro, Nyarugusu and Lwamagasa and in the town of Geita.

Media Coverage

As part of the GMP strategy to disseminate information, media were constantly advised of project schedule and events and were invited to observe project activities to assist in their reporting. Radio and television press releases announced the TDU launches and provided updates on the status of the project activities. Coverage of the GMP TDU activities in Tanzania occurred on 3 different occasions in 5 different newspapers and on 3 television networks. A total of 16 newspapers articles featured the GMP initiatives and goals. Among the newspapers that reported on the activities were: The Guardian, Mwananchi, Habari leo and Msanii Africa newspapers. Shortly after the TDU launch in Lwamagasa village, Star TV Network of Mwanza featured a one-hour program on mercury awareness.

VIII. Implementation of the Awareness Campaign, Lwamagasa Village

Rwamagasa village, located in the heart of the Rwamagasa belt, is the target of the GMP. Rwamagasa Village is divided into 5 vitongoji (sub-villages): Elimu, Isenyi, CCM, Lubinga and Imalanguzo, all of which strongly depend on the services available in nearby Geita town. In Rwamagasa Village, the local population (26,990 people) relies on ASM in conjunction with livestock, farming and fishing. The majority of residents rely solely on ASM (54%), while 14% conduct mining in conjunction with farming and small business enterprises. Although many residents are driven to ASM by economic hardship (21%), particularly since the late 1990's, a great number do so out of family tradition (78%). Subdivided into five sub-villages, Rwamagasa village is comprised of 5,017 households with an average size of approximately 5 people.



Figure 3: Lwamagasa Village

The activities in Lwamagasa village were aimed at raising awareness of the dangers of exposure to mercury and losses incurred during the use of inappropriate technologies. This goal was complemented by the provision of appropriate technology and skills for improved gold extraction, better health and protection of the environment. The awareness campaign was also aimed at encouraging all members of the community to participate in project activities and to take a collective approach to dealing with the issue of mercury use.

The awareness campaign was launched at Lwamagasa village on March 7, 2007. It was followed by six-day trainers' capacity building workshop at Blue Reef Mine. The training and TDU activities occurred the following week and were on going for the next two months.

The Launch was attended by the District Commissioner of Geita, a UNIDO representative, and senior members of the government. The Mgusu community theatre group provided performance around key GMP messages and the event was well attended by the community. The launch was covered by the media in 5 newspapers, and on 3 nation wide radio stations (radio free Africa, Radio Tanzania, and radio One). ITV in Dar es Salaam aired the events on their evening news.

The training and demonstration sessions were conducted by trainers (most of whom had attended the training of trainers workshop in May 2006) and village leaders. Among the topics covered was health and sanitation focusing on communicable diseases, sanitation and protection of water sources. The teaching methodology was designed in response to an educational needs assessment conducted during the 2006 trainers workshop. The 5 day trainers' capacity building workshop was attended by 32 people including mining technicians, health officials, miners and divisional/village administrators.

The topics covered in the training sessions and demonstration activities included components such as gold extraction methods and ore crushing/grinding, health and sanitation, water recycling and protection, gold amalgamation processes, proper burning of amalgam, and marketing of gold. Course duration varied depending on the module and attendees. The structure of the training allowed for the technical subjects of interest to the

attendees to be covered off first, however, all participants were required to attend sessions focused on environmental protection and health and sanitation.



Figure 4: Villager presenting the benefits of using a retort

The GMP training site at Blue Reef Mine, Lwamagasa, accommodated more than 60 people and was equipped with a desktop computer, multimedia projector, screen, white board, blackboard and sound system. 1430 villagers attended the courses at the TDU centre. Approximately 220 courses were given between March 14 and May 15 2007. Among those in attendance were owners of gold recover centres, ore grinders, gold brokers, women's groups, gold mining SACCOS, Hekima women SACCOS and private operators. Training was also conducted at two primary schools in the village where 552 students and 20 teachers were involved.



Figure 5: Training Site at Lwamagasa

A special training session was also provided to village council members in an effort to transform the way the local government viewed issues of environmental protection and the dangers of mercury emissions and tailing disposals. An indicator of success in this instance is that since the training session, the village council now has environmental issues on their meeting agendas. The village councils have undertaken to monitor behaviour change within their communities and to take action in response to complaints related to the use of mercury. The medical at Nyarugusu began a program whereby he provides patients with informational sessions related to health, sanitation and the dangers of mercury poisoning. The sessions assist not only in teaching the importance prevention but also in identification of symptoms and signs and mercury poisoning.

As part of the awareness campaign, audio visual displays were used to educate over 8500 people during 28 video shows.

IX. Implementation of Awareness Campaign, Nyarugusu

Nyarugusu has a population of approximately 23,000 people making it one of the largest villages in Tanzania. It has eleven sub-villages with some being located up to 8km from the main sub-village. Due to the size of Nyarugusu, 4 training centres were established to ensure as many miners would attend the activities. 220 villagers received mercury testing and counselling from the team of health officers and the Lumex technician during the week of July 6, 2007.

The awareness campaign was launched at Nyarugusu village on May 17, 2007 and was followed by training and TDU activities. About 3900 villagers attended the training courses including: owners of gold recovery centres, gold brokers, private operators, primary license holders, sluicing operators, ore porters, and women's groups. In addition to the 1855 students who attended training at 3 primary schools, 4800 people attended field demonstrations in Nyarugusu centre and its sub-villages.

X. Indicators of Success: Project Impacts and Behaviour Change

1. **Recovery of Mercury.** It is estimated that at a minimum, 1kg of mercury is being recovered and activated for reuse every day in Lwamagasa and Nyarugusu villages. This assessment was based on the amount of mercury recovered by 100 out of more than 230 retorts used in the villages. If production is good it would be appropriate to double the amount of mercury recovered per day to 2kg. This is recovered daily by the use of retorts and proper storage of mercury at Nyarugusu and Rwamagasa villages. Miners from other villages have also started to use retorts but it was not possible to ascertain the amount of mercury that has been recycled.

2. **Increased awareness among youth and community demands for policing.** Several weeks after the awareness campaign began in Lwamagasa, the project team started to notice children raising questions and reporting gold buyers who were burning amalgams in the open or processing gold near residential areas to village leaders. The village executive secretary had 7 letters addressed to the village chairman accusing other people within the community of burning amalgams without using retorts and there were 21 verbal accusations related to mercury emissions during the first week of August 2007. Between October and November 2007 there were 10 written complaints in Lwamagasa village and 2 in Nyarugusu. The offenders in Nyarugusu were fined two bags of cement for their offenses..

3. **Agreement by local leaders to train other fabricators on making retorts locally.** Local leaders have decided to provide training to fabricators who were unable to participate in the activities at Lwamagasa. This training will enable a larger number of local fabricators to produce retorts hence increasing the number of retorts available to users in the community. In both communities trainers met with village fabricators and gave them retort models. 5 welders were trained to make locally produced retorts.

4. **The Community Service Committee has allocated land to be used for washing ponds that is away from water bodies.** Washing ponds have been moved away from river channels and other water sources demonstrating the local leadership's commitment to environmental protection and community health. Old locations were within the village water catchment area and contamination of drinking water was a serious health concern. There has been an obvious increase in awareness of the importance of protecting water sources and the environment and this initiative demonstrates that behaviour has changed in response to increased levels of awareness.



Figure 6: Relocation of washing pond away from the river channel

5. Mandatory training for polluters. There is now agreement among local leaders that polluters attend mandatory training sessions rather than immediately facing prosecution. This demonstrates confidence in the effectiveness of the GMP training program on behaviour change. It also demonstrates that communities are no longer tolerating polluters and are taking action to combat the problem.



Figure 7: A locally fabricated retort

6. **Use of retorts.** Several behaviour change monitoring activities were undertaken by the project team and the village executive officer. In August 2007 Dr. Kinabo conducted a four-day assessment of project activities at Lwamagasa and Nyarugusu. A checklist was used to identify changes made by gold buyers and owners of washing ponds. The results of reviews reveal that most operators have started to change their work performance. At the end of July 2007, 95 retorts were consistently used by miners in both areas. This is considered a significant success as it represents the first time ever that Tanzanian gold operators willingly use retorts and acknowledge the importance of their use.

7. **Construction of walls.** Other indicators of behaviour change were noted such as the protection of agricultural produce from mercury contamination in washing and amalgamation sites. It was observed that miners operating close to flood vulnerable areas have started portioning working areas by building walls to control tailings spillage. Amalgamation ponds in or near riverbeds have been closed down and new growth of grasses has been noted. This will have a significant impact on the watershed hydrology and water quality of rivers draining into Malagarasi wetlands and Lake Victoria. Six water wells in Nyarugusu have been protected by walls.

Other observed indicators of project success include:

8. **Improved ventilation and use of safety gear and retorts by gold buyers.** The project team observed improved ventilation, use of retorts and safety gear by gold buyers in both communities. A short survey at Rwamagasa village showed eight out of ten gold buying offices have modified their offices to improve air circulation and light. The village has more than 62 gold buyers most of them small operators. Two types of retorts have been produced by local fabricators. About 1800-2500 miners in Geita District are currently using an available 230 retorts.

9. **Responsible economic transactions.** Miners are preferring to sell their gold to brokers with proper retorts.

10. **Enforcement of local regulations around safe practices.** Gold brokers without proper retorts are prohibited from operating in the village centres.

11. **Medical counseling and mercury testing.** The majority of gold dealers sought medical counselling and mercury blood tests. 220 villagers had testing. Out of the 220 people tested, 38 miners had clear signs of mercury intoxication – 7 of which are acute cases. 22 gold brokers received medical counselling in Lwamagasa village. In Nyarugusu 176 miners received counseling. Between April and July 2007, 25 gold buyers requested medical counselling. Between August and November 2007,

12. **Safer practices for improved health occurring in other professions.** Food vendors have made efforts to improve the handling of food.

13. **Better health from improved sanitation and hygiene.** A drastic fall in number of cases of diarrhea resulting from improved sanitation and hygiene has been observed since the Awareness Campaign at both sites. During the month of July 2007, the Nyarugusu medical officer noted a 70% decrease in diarrhea cases.

14. **Participation of local leadership in monitoring activities.** Village leaders and council are actively involved in monitoring activities and decision making.

15. **Local Capacity Building.** Health officers and Mines Department technicians conducted most of the training after attending an initial Training of Trainers in Geita in 2006 and subsequent training refresher classes. This built capacity within the community and trainers continue to educate other members of the community as a means of ensuring additional and continued capacity building.

16. **Safe practices to address concerns associated with dust.** An increase in use of dust masks and operators of batch mills are wetting discharge parts to reduce dust.

17. **Investment in better technology by miners.** 5 miners are planning to order stone crushers, riffled sluice boxes and plastic pans from TDU suppliers.

18. **Action by local government.** The village government of Rwamagasa has included mining and environmental issues as permanent agenda items in its council meetings. Most of monitoring and follow up work is now been done by the village leaders such as prohibiting washing ponds in residential areas and prohibiting tailings discharges close to the water bodies. Before the Awareness Campaigns this was considered to be the responsibility of the Mines Department which does not have sufficient staff to be stationed in all mining villages.

XI. Challenges

Despite the significant accomplishments observed since the GMP activities in Lwamagasa and Nyarugusu, several challenges were noted.

Batch-mill operators had an inaccurate perception of the efficiency of the TDU crusher-miller. The current operators raised unfounded claims about the costs of operating a modern crusher despite field-test showing that the new crusher's performance was 10 times greater than the classic batch mills. In addition, the owners of washing ponds would not allow gold miners to use improved sluicing methods on their premises. The reason for this situation is that washing pond owners allow miners to use sluices for free provided they leave the tailings behind for further processing. It is in the best interest of the owner to have poor recovery during the first washing. The arrangement is exploitative at best and requires additional intervention to ensure equity and opportunities for miners to access improved technology.

It has also been noted that there are signs of new mining immigrants to riverbanks and flooding plains that had been evacuated by resident miners. This and the involvement of most miners in gold rush activities complicates the monitoring of change and makes it more difficult to ensure that all miners have received training and are complying with safer mining practices. During the months of July and August 2007, groups of miners from Bukombe and Biharamuro district came to the project area. Without strong leadership, regulations and training these groups can have a drastic impact on the environment and community health.

It has been suggested that next steps should include continued training activities to ensure that behaviour change is long term and to reach miners who did not participate in previous activities. Tan Discovery has also recommended that incentives be provided to village leaders who are currently monitoring behaviour change to ensure that this process is most effective and that tracking and reporting continues. In addition to the allocation of funds and incentives, it has been recommended that the government allocate more land to ASM in an effort to minimize illegal mining activities. Authority to prosecute repeat polluters is also suggested in order to respond effectively to community complaints and to reinforce the message that protection of the environment is imperative. Geita Resident Mines Office has been mentioned as being in need of funds to sustain extension services, conduct inspections, continue TDU activities and introduce entrepreneurship training and credit facilities.

XII. Conclusion & Recommendations

Training and demonstration activities undertaken by Tan Discovery Consultancy Limited occurred over a five-month period. The first 2 ½ months (from 7th March to 16th May 2007) focused the project activities at Rwamagasa village. During the remaining two months and three weeks (from 18th May 2007 to 8th August 2007) the training activities were conducted at Nyarugusu village. During this period the project team maintained extension services at Rwamagasa village.

At Rwamagasa about 1430 villagers attended class training with an additional 2700 attending field demonstration activities. Training was also given to 522 pupils and 20 teachers from the two primary schools in the village. At Nyarugusu village about 3900 people attended class training courses and 4800 attended the field demonstration activities. Training was also provided to 1885 primary school children from Nyarugusu sub-villages. It is estimated that in the next six months 5000 miners will have been educated with the GMP materials.

The following indicators of project success were noted:

- About 98 retorts are now being used daily by artisanal miners and gold buyers in Rwamagasa and Nyarugusu villages. It has to be noted that most of the retorts are owned by gold buyers who purchase small amounts of gold from individual miners. A single retort is used by more than ten people daily. This is the first project in Tanzania to see miners are willingly using retorts to protect themselves against dangers of mercury vapor.
- Up to the end of October 2007, four local fabricators had made more than 230 retorts currently used by miners in Geita district. The fabricators now have additional income from the sale of retorts.
- Most of the mercury recovered by retorts, about 1kg per day, has been activated before re-use.
- Washing pond owners at Rwamagasa village purchased two water pumps, capable of supplying water to 20 washing ponds away from the water bodies. In the past most of the ponds were within the river channels.
- 15 washing ponds have been relocated away from water sources and far from the village.
- The village government of Rwamagasa has included mining and environmental issues as permanent agenda items in its council meetings. Most of the post project monitoring and follow-up is now been done by the village leaders such as prohibiting washing ponds in residential areas and prohibiting tailings discharge close to the water bodies. Before the project awareness campaigns this was considered to be the responsibility of the Mines Department which does not have sufficient staff to be stationed in all mining villages.
- A short survey at Rwamagasa village showed eight out of ten gold buying offices have modified their offices to improve air circulation and light. The village has more than 62 gold buyers - most of them small operators.

Recommendations derived from the activities in Lwamagasa, Geita and Nyarugusu are as follows:

- ❖ Conduct a baseline survey to assess the impacts of the Awareness Campaign and training activities.
- ❖ Conduct meetings with stakeholders to discuss other indicators of behaviour 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 behaviour change monitoring activities
- ❖ The government should allocate more mining land to ASM to minimize illegal mining activities,
- ❖ 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
- ❖ Entrepreneurship training and credit facilities to disadvantaged groups are necessary to address the exploitative practices of most gold brokers and washing pond owners.

It is evident that the Global Mercury Project activities in Tanzania have resulted in significant benefits to the communities in Geita District. Continued action is required in order to reach other miners and their communities in Tanzania. This work is required to ensure sustained benefits and to successfully eliminate the unsafe use of mercury in artisanal and small scale mining in Tanzania.