

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Project Document Transmittal Sheet

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Title: Introducing new technologies for abating mercury pollution caused by informal gold mining operations in Tanzania

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(incl. support costs)

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Project of the Government of the United Republic of Tanzania
Project Document

Project number: TF/URT/94/G10 **Control no.:** 8513

Title: INTRODUCING NEW TECHNOLOGIES FOR ABATING MERCURY POLLUTION CAUSED BY INFORMAL GOLD MINING OPERATIONS IN TANZANIA

Planned duration: 30 months

Project site: Dar-es-Salaam and field areas, Tanzania

Trust Fund Contribution: US\$ 368,855 including 13 % Programme Support Cost

**Host Country/
Implementing Agency:** **Ministry of Energy and Minerals** in cooperation with Southern African Mineral Resources Development Centre (ESAMRDC); Cleaner Production Centre of Tanzania (CPCT); The National Environmental Council

Executing Agency: United Nations Industrial Development Organization (UNIDO)

Estimated starting date: First quarter 1997

Government inputs: Project staff and office accommodation

Brief description

The lack of proper health and safety procedures, adequate working tools, appropriate technology and basic infrastructural facilities in the informal gold mining sector of Tanzania have led to mercury pollution, environmental degradation, and revenue losses. The project will introduce more efficient gold recovery and cost effective gravity gold concentration methods that minimize the utilization of mercury and stop the dangerous pollution of water courses and Lake Victoria with the toxic metal. Since a great majority of the informal (artisanal) miners are women, due emphasis will be laid on their emancipation and integration into the industrial development of the country. Reducing environmental hazards would be an important component of the project strategy which is to introduce technology and equipment that can be produced by the miners themselves, or fabricated at low cost by modest facilities in major cities.

Signed:

Date:

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For the Government

UN official exchange rate at date of last signature US\$1.00 = T.Shs.

Executive Summary

Mercury is one of the most toxic substances in the world causing significant damage to the environment and to the health of people who handle it. Mercury is absorbed by the human organism through drinking water, food or breathed air. Mercury is used extensively by artisanal gold miners in Tanzania. Their activities provide income to 300,000 to 500,000 people; a great proportion of the miners being women. For every gram of gold recovered, about two to five grams of mercury are released into the environment - often resulting in the death of men, women and children and in a permanently ruined habitat. The relevant simplicity and effectiveness of the technology, known as amalgamation, mask its dangers. This process can be improved with procedures using inexpensive and highly efficient devices which can be manufactured locally at low cost.

The objective of the programme is to replace mercury amalgamation with new technology while improving the income of the miners through more efficient recovery and to provide governments policy advice on the regulation of artisanal gold mining with due consideration for gender issues.

The primary target beneficiaries will be artisanal miners - men and women alike. The secondary beneficiaries will be the Government, local institutions and the society at large due to the very nature and extent of the damage caused by artisanal mining.

The activities will mainly be directed towards the introduction of safe and high-yield extraction methods that could preempt the use of mercury - i.e. introduction of production of equipment for the new technology and its dissemination; training of local manufacturers; training of miners, especially women, for competitive alternatives to mercury amalgamation; awareness creation on the protection of the environment as well as policy advice to governments and local institutions.

*Based on the experience gained in UNIDO, **US\$ 368,855** are required for the implementation of the programme in Tanzania.*

1. CONTEXT

Artisanal gold mining - manual mining without mechanical assistance and rudimentary methods of metal extraction - has a history as long as mankind. With the continuous development of the formal sector it might be expected that this primitive form of gold production would be dying out. Far from it; over the past 25 years artisanal gold production has seen a world-wide resurgence. In sub-Saharan Africa, for instance, it is estimated that well over 40 t of gold are produced from such "mines" annually, worth about \$500 million and employing about 1.5 million persons.

In many developing countries, artisanal gold mining has become a major safety-valve, cushioning the worst effects of structural adjustment, recession and drought by providing people in the rural areas with an alternative or complementary way of securing a livelihood. The very characteristics that have made artisanal gold mining a source of anxiety and concern to Governments is the severe impact on the environment and the danger to human life because of the extensive utilization of mercury.

Over the last 12 years, many conferences were held on what was called "small-scale mining". These conferences provided interesting reviews of the situation, but could not come up with strategies to deal with the phenomenon. By the early 1990s it was clear that a policy of treating artisanal miners as a marginal mining sector had failed. The turning point came at a conference sponsored by the U.N. on "Small and Medium Scale Mines" in Harare in 1993. A set of guidelines issued at the end of the conference noted that it was not necessary to split up the sector, and hence there was no need to define the scale of such mines; all mining should be undertaken under one legal system. This signaled the reversal of the previous positions whereby artisanal miners were regarded as engaged in a deplorable activity, to be segregated from the normal mining sector, and to have no real property right on their findings.

1.1 PROBLEMS ADDRESSED

Use of mercury and its impact on the environment

Mercury (Hg) contamination is considered to be one of the worst hazards among anthropogenic impacts upon the environment. In many developing countries of Africa, Latin America and Asia, the toxic metal is widely used for the separation of fine gold particles through amalgamation from river sediments, soils or rock. After the amalgamation, the gold containing Hg alloy is generally burned in retorts, but in many areas this operation is also carried out in open air emitting Hg vapor to the atmosphere. During the amalgamation process, a variable amount of Hg is lost to rivers and soils.

In Tanzania, the situation is especially precarious because of the potential danger of poisoning the water of Lake Victoria being a drinking water reservoir for several countries. Artisanal mining operations take place in its vicinity and effluents from gold washing and amalgamation operations are discharged into small rivers being tributaries to the Lake.

The mercury process has been used for centuries, but it is now recognized as devastating to health, not only to users but to those indirectly involved, including the unborn, through peripheral contamination and introduction into the food chain. Life-threatening Hg pollution has been identified in most developing countries where artisanal gold production is taking place.

Mercury is one of the most toxic substances known. Its poisoning causes brain and neurological damage, organic dysfunction and death. Women are particularly at risk since they play a large role in artisanal mining, especially the mercury handling end of it. Mercury passes the placenta barrier very well in pregnant women and accumulates in the fetus with resultant mental retardation of the child. Through peripheral contamination and introduction into stream waters and the food chain, it also causes poisoning among people whose diet includes local farm produce or fish taken downstream of gold mining areas. Samples of fish netted below gold operations have revealed mercury concentrations 5 times the permissible limit.

It is estimated that one third of the entire world gold production derives from artisanal and small-scale operations. Applying artisanal methods, up to five grams of mercury are lost to the environment when producing one gram of gold. In Brazil, the available evidence shows that nearly 300 tons of Hg are annually lost to the environment. A total of 1,000-2,000 tons of Hg has accumulated only in the Amazon ecosystem. The same problem exists in Africa, however, reliable data on the extent of Hg pollution are difficult to obtain.

In contrast to other chemicals causing spectacular accidents when being released, mercury has the potential for long-term, time delayed impact and is, therefore, regarded as "chemical time bomb". The environmental concern for the toxic metal is evident given the past occurrences of the "Minamata disease" in Japan and innumerable cases of Hg intoxication in developing countries.

Damage caused to Habitat in Tanzania

Artisanal gold mining and extraction are carried out by men and women working interchangeably. Depending on the geological situation, gold is extracted from either river sediments or concentrated by processing the ore from small primary deposits. In both cases, the main tools for concentration are the so-called sluices and pans. Gold panning is the worst form of extraction with devastating consequences to the environment as it involves siltation, digging up river beds and utilization of mercury.

Since this technology is not only applied in Tanzania, but also in Kenya and Uganda (both countries bordering Lake Victoria), a mercury catastrophe would appear to be in

the making. Villagers are using mercury with disastrous abandon, even burning off mercury residues in pots which women use later for cooking purposes.

Depending on the season, up to 500,000 people pan for gold from river sediments and hard rock. The extent of damage which has been inflicted on the natural resources is horrendous. Serious degradation of the river courses and their contamination with silt and mercury has become a common feature due to gold panning.

Loss of gold resource

In many areas of Tanzania, artisanal gold mining is the only significant cash generating industry. The artisanal and small-scale gold mining sub-sector is now the main contributor to the country's mineral export earnings. In 1992, 76% of all mineral export earnings were from gold mining by artisanal miners. These operations are leaving, however, about 75% of the gold unrecovered. This is doubly unfortunate, because: 1) at an estimated production of 15 tons per year, 45 tons of gold are left unrecovered 2) unless these methods are changed soon, the considerable gold resources exploited on artisanal basis in Tanzania will eventually be mined down to grades that are economically unexploitable by any method.

1.2 HISTORICAL BACKGROUND OF GOLD MINING IN TANZANIA

Gold mining has dominated the Tanzanian mining industry for more than a century. Records of organized prospecting and mining dates back to the German colonial period with gold discoveries in the Lake Victoria Goldfield in 1895 (MEM, 1991). During this time the gold mining was based on alluvial and near surface rich deposits around Lake Victoria. A small-scale mine was opened at Sekenke in 1909. Production figures prior to 1922 are very scanty. There were intensive prospecting starting 1921 following earlier enactment of a mining law by the British administration. This led to more discoveries of gold deposits in the Lupa and Lake Victoria areas. By the mid 1930's five well defined goldfields had been discovered (Geosurvey, 1979). These goldfields include: Iramba-Sekenke, south-west Mwanza, Musoma, Lupa and the Mpanda Mineral field. The first three goldfields are collectively known as the Lake Victoria goldfields.

Small mechanized mining operations were first introduced in Musoma in the Lake Victoria Goldfield. The mid 1930's saw the opening of several medium scale mechanized gold mines including Kiabakari in 1934 and Geita mine in 1939. Before and during the second World war gold was the most valuable mineral export of the then Tanganyika. Record exports were attained in 1940 with a value of L 1.2 million (Harris, 1961).

The effects of the second World War led to abandonment of small-scale operations and hence a sharp decline in gold production. Though erratically, post-war period up to 1960 saw a rise in gold production. Unlike the pre-war period when production was based on small-scale operations, medium -sized mechanized mines were the main

producers. Peak production of over 106,000 ounces was attained in 1960. However, these successes were followed by another sharp decline in gold production starting in 1960. The start of this decline was a result of closures of several mechanized mines. e.g. Mukwamba in 1960, Geita and Kiabakari in 1966 and then Buhemba in 1970. Following these closures, gold production dropped from over 3 tonnes per year in the early 1960's to 10 kg in 1970 (Parker, 1991). Apart from exhaustion of reserves in some mines, the gold price of US\$ 35.00 was too low to sustain economic operations. By the time the gold price rose again in the early 1970's, the political climate had made investment in Tanzania unattractive. The period 1950 to 1960 saw a great deal of exploration work notably by the big companies, e.g. Anglo American and its subsidiary the Western Rift Exploration Co., New Consolidated Goldfields, Mbeya Exploration Co., Colonial Development Corporation, Bilton, etc.

The State Mining Corporation (STAMICO) was formed in 1973 to oversee all mining operations in Tanzania. Recorded gold production between 1970 to 1980 was 27 kg. In spite of this declining production, geological and exploration work was carried out by different companies. Russian teams carried out gold exploration in the Lupa Goldfield, a Dutch team working in collaboration with STAMICO investigated for gold in the Sekenke area. UNDP explored the western region of the Lake Victoria and Geosurvey carried out an airborne geophysical survey of the whole country. However, by the 1980's there was only one small mechanized mine, Buckreef Gold Mine, operated by STAMICO. The recorded official production for the period 1981 - 1989 was 621.24 kg of gold with Buckreef producing 340.86 kg, small-scale miners - 36.28 kg, DTT (a foreign company) - 225.3 kg, and TAMIDA (Tanzania Mineral Dealers Association) - 18.8 kg. The decline in the formal gold production, however, led to flourishing of illegal gold mining. Estimates of illegal gold production in the late eighties is put around 15 tonnes per year.

Policies of liberalization of the economy

In 1990, the government introduced policies aimed at liberalizing the economy. This has seen renewed interests by investors in the mining industry, which has resulted in 51 % and 24% growth of the mining industry in 1991 and 1992, respectively. In addition, the government introduced measures aimed at controlling illegal gold mining, activities which were common within the small-scale mining areas. As a result, between April 1990 and April 1994, a total of 13.84 tons of gold were purchased by the Bank of Tanzania. The artisanal and small-scale gold mining sub-sector is now the main contributor to the country's mineral export earnings. In 1992, 76% of all the mineral export earnings were from gold mining by artisanal miners. This realization has prompted the Government through the Ministry of Energy and Minerals (MEM) and in collaboration with the World Bank to launch a mineral sector development technical assistance project. The project aims at expanding private investment in mining and other mineral based industries through sector policy and institution reforms (MEM, 1995).

Given the nature of the artisanal mining industry, both mining and processing technology remain rudimentary.

Gold deposits in Tanzania

The goldfields discovered in the mid 1930's remain the most important gold mining areas to date. Small amounts of gold, mainly alluvial, are mined in newly discovered areas like Dodoma, Mbinga, Ludew and Mabadaga by artisanal miners. The most important of the goldfields named above is the Lake Victoria Goldfield. The deposits in this goldfield are of four types namely:

- (i) Auriferous quartz reefs and stringers
- (ii) Auriferous sulphide impregnations consisting large-scale disseminated sulphide replacements of banded iron formations (BIF)
- (iii) Eluvial gold deposits (rubble) in laterites, and,
- (iv) Alluvial or stream sediment placer deposits.

Other gold occurrences in Lupa and Mpanda gold/mineral fields are hosted in proterozoic metamorphic rocks of the Ubendian system.

As mentioned above, the Tanzanian gold mining industry has gone through cycles of decline and revival. Currently the industry is in the revival cycle following the government's new policies encouraging private investment. Between 1990 and 1995, about 200 reconnaissance and prospecting licences have been granted to different companies in mining areas.

1.3 SUBSISTENCE SMALL-SCALE (ARTISANAL) MINING IN TANZANIA

Before the 1990 mining policy reforms, marketing arrangements for the artisanal mining operations in Tanzania were not elaborate and competitive although a few attempts were made by the government and its institutions. For example, STAMICO instituted gold buying units which later run into financial and organizational problems. As a result illicit mineral dealing were associated with this sub-sector. In addition, organizational problems made licensing of most artisanal operations almost impossible which led to nearly 15 tonnes of gold per year being mined illegally. Following the 1990 policy reforms, gold marketing arrangements were liberalized and established through the Bank of Tanzania. Miners were encouraged to peg their claims, organize miners' co-operatives and societies and as a result there was a substantial increase in legal artisanal operations most of which earlier operated illegally. Whilst there are still substantial numbers of miners operating without licences, there has been a lot of success in licensing small-scale mining operations.

Since April 1990 till to date 10,000 claim titles have been granted to artisanal and small-scale miners. It should be mentioned here that artisanal mining is reserved for local Tanzanians. The Mining Act, 1979, is however being revised to allow joint local and foreign participation in claim development. The revision is intended to avail capital and technology to Tanzanian claim title holders.

The commonest mode of operation utilizes claim holders, who in most cases are companies, individuals or associations. Company claim holders usually engage in mining or lease some of the areas to individuals, or pit owners. Pit owners are usually in charge of mining activities and they employ between 5 and 20 miners per pit. Individual claim holders are usually those who have followed the lengthy procedure for pegging a claim according to the Mining, Act, 1979. Many individual claim holders are business men or individuals still in formal employment and hence it is common to hire pit owners who are then responsible for organizing extraction. Associations usually take claims on behalf of their members. Pit owners are usually poor and unable to provide working tools or food for the miners. In most cases claim holders, mineral traders and brokers provide sponsorship for mining activities. Traders and brokers provide sponsorships on conditions of guaranteed sales from the winnings. Although the new market arrangements have encouraged most miners to sell their gold through official channels, it is believed that substantial amounts still find their way to illegal channels. This could be attributed, one to differences in prices where the official gold price per gram is Tshs 4500.00 while the parallel market price is Tshs 7000.00. Other reasons can be attributed to poor organizational structures, lack of adequate infrastructure, marketing information, etc.

Many artisanal mine workings are not new discoveries but developments on old formal mines. Such workings can be found at Siroli Simba, Mobrama (Nyabirama), Kibaga and old Geita mines all in the Lake Victoria Goldfield. Mining in such mines include mining of crown pillars, reworking of tailings and waste piles, etc. Many new discoveries are made by purely luck. Some mines have been discovered by farmers, herdsmen or people digging latrines and encountering small nuggets in the process. Examples of these include discoveries at Bulyanhulu, Nyabigena and Serengeti in that sequence. One of the important recent discoveries is that at Mugusu, 19 km from the old Geita Mine in the Lake Victoria Goldfield. The mine was discovered by miners in 1988 trying to rework the gravel from an exploration left behind on the Saragura-Mugusu hill. The mine has 320 pits out of which 120 were active by October 1995. It employs nearly 15,000 people who are engaged in activities ranging from mining and ore processing to trading and provision of social services. Output from Mugusu is around 5-10 Kilograms of gold per month. In Tanzania as a whole, it is estimated that between 300,000 and 500,000 people are engaged in artisanal gold mining and its associated activities.

Mining is usually conducted through pitting. If a claim has been subdivided into smaller sections, pits are dug at average intervals of 3-5 m apart. Digging is done straight down on reef until secondary enrichment is encountered. At Mugusu Mine, pits as deep as 100 m have been excavated. In order to ease miners movements down deep pits, the notches are dug every 10-15 meters to allow resting in between ascending and descending the pit. Once secondary enrichment has been encountered, ore is mined laterally to the limits of the pit sections. Mining tools, most of which are fabricated locally within the mining centers, include chisels, hammers, single sided picks (locally known as Sokomoko).

Pits are usually well timbered through the weathered top ground and at the mining levels. In certain areas like Mugusu where timber is expensive, timbering is only done in the top bad ground patches. Timbering is usually carried out by experienced miners most of whom have worked in formal mines before. These are specialist gangs who move from site to site providing such services. Cribs are first constructed on surface and then taken to required areas in pieces.

Most pits are now utilizing simple wooden winches for hoisting material to surface. Deep pits have devised some form of wooden pulleys and thus allowing the winch to be sited away from the pit. However, the limitation of the winches to vertical section only, still lead to a lot of delays and hence limiting miners outputs.

Use of mercury in artisanal mining

Once ore has been hoisted to surface, it is manually crushed, first by using 4 lb hammers to reduce it to minus 10 mm after which it is crushed in a hardwood mortar by using a vehicle half-shaft as a pestle. In certain cases, women and children carry out fine grinding using grinding stones. Mosquito gauze screens are used for product classification. Richness of the ore is usually established by simple panning test of a fine ground sample. If the ore is very rich, it is then panned directly and the concentrate amalgamated. The less rich ore is moved down the river or any other water source and concentrated through locally made sluice boxes. The amalgam is then heated on a spade or can in open air to recover the gold bullion. Retorts made by the University of Dar es Salaam's Institute for Production Innovation (IPI) have successfully been tested in Lupa, Dodoma and the Lake Victoria areas. However, during a recent UNIDO field mission, none of those sectors have been seen in operation. The reason for which the retorts are not being used might lie in their cumbersome size and the slight greenish decoloration of the gold occurring after heat treatment in these iron retorts.

Artisanal mining processing techniques usually lead to substantial losses due to the inability of the process to recover very fine gold e.g. below 50 microns. A study carried out on 70,000 tons of tailings from these activities by Tan Range Exploration, (Tan, 1993) shows that up to 0.36 ounces per ton of gold can be recovered from these tailings. The study further shows that up to 1.0 million tons of tailings are generated annually through these activities. Some improvised equipment like a ball-mill driven off a tractor can be found in some artisanal operations.

1.4 INSTITUTIONAL SUPPORT FOR THE ARTISANAL GOLD MINING SECTOR

Within the Ministry of Energy and Minerals Department of Mineral Resources (MRD), there are four divisions, i.e. Mines Division, Geology Division, Research and Laboratory Division and Minerals Trade Division. The department has its headquarters in Dodoma with the office of the Commissioner for Mineral Resources and the Minerals Trade Division based in Dar es Salaam. The department through its divisions and zonal offices scattered across the country is supposed to offer professional services, carry out the regulatory, monitoring and inspection duties, licensing, offer extension services to the

artisanal mining sector, etc., to the mining industry. However, the lack of adequate resources to execute its functions, has made its effectiveness very dismal. With the mining industry continuing its revival and moving towards private participation, the Ministry of Energy and Minerals (MEM) in collaboration with the World Bank are conducting a restructuring exercise of MRD. The Department of Mineral Resources has an institute, "Madini Institute", based in Dodoma and is intended to produce mining technicians with Full Technicians Certificate. However, the lack of funds and trainers have had adverse effects on its performance.

The Eastern and Southern African Mineral Resources Centre (ESAMRDC), an institution supported by 6 member countries of the Eastern and Southern Africa Development Corporation, SADC, is based in Kunduchi, Dar-es-Salaam. The Centre offers research and laboratory services to the mining industry on purely commercial basis. ESAMRDC will be ready to participate in the project implementation especially during phase 2 of the implementation schedule. The institution will be involved in the analytical work of installation, commissioning and determination of its economic viability to the small-scale miners of the pilot plant.

The project experts will conduct field work in the Lake Victoria Gold Field and select suitable site for the installation of the pilot plant. They will conduct tests on ore dressing and processing using the ESAMRDC facilities at Dar es Salaam together with expert advice from the technical personnel of the institution. The ESAMRDC is implementing a UNIDO project (US/RAF/90/190) aimed at strengthening the industrial mineral laboratory capacities of the institutions.

With regard to the Cleaner Production Centre of Tanzania (CPCT), they will be involved in the evaluation of the appropriate technology to be involved as well as modification of the available plants and machinery to suit the needs of the small-scale miners. In collaboration with the project staff, they will advise the project on any new methods or technology to be adopted so as to abate mercury emission into the atmosphere.

1.5 RESEARCH AND MANUFACTURING EXPERIENCE AND PROBLEMS

Most technological problems in the gold mining industry, affect small-scale miners most. For a start, most people associated with small-scale mining in Tanzania have no technical know-how. Secondly, the country has a shortage of mining technicians through which skill-transfer to artisanal miners could be effected. The problem of dissemination of information across all parties is a serious one. Miners are usually not informed of facilities available within the country and when literature is available it is usually written in English which most miners do not comprehend. Researchers and manufacturers alike are usually not aware of which technological problems to deal with. In other words, there has not been any research to identify which technological problems are facing the industry.

At the national level there are only two training institutions associated with mining. These are the Geology Department of the University of Dar-es-Salaam and the MRD Madini Institute based in Dodoma. The Geology Department produces nearly 10 geologists a year most of which used to seek their employment through the Government and its institutions. However, since the 1990 policy reforms, there are many private firms looking for geologists, especially in the gold mining industry where exploration is booming. On the other hand, the country's lack of local training facilities for other mining related fields has led to imbalance in manpower skills which in turn makes research in certain areas either impossible or sub-standard. Areas like mining engineering and its specialized fields like ventilation a mine survey, geotechnical engineering, geophysics, mineral economics, etc., lack well trained professionals.

Support services for the gold mining industry can be easily reached from areas surrounding the mining areas. Mechanical and electrical engineering workshops in towns like Mwanza, in the lake Victoria region and in the south of the country, offer sophisticated services. However, other remote mining areas, especially those discovered by artisanal miners, still rely on the ingenuity of a few artisans. Further to the disadvantage of these operations is the lack of the basic infra structural facilities to such areas, e.g. roads that could allow support services to be reached. Some mechanized operations like that at the former Buckreef Gold Mine have their own workshops which cater for most jobs. It is fair to say that existing facilities in the country do not yet cater for the country's technological needs.

2. WHY UNIDO?

Since 1990 continuous efforts have been made by UNIDO to provide assistance to the small-scale mining sector, in particular to the artisanal gold mining sector. The requests for such assistance were forwarded to UNIDO especially from those governments which had become increasingly aware and concerned about the dangers involved in these activities. Within the last two years, UNIDO provided assistance related to artisanal gold mining and avoidance of mercury pollution to Botswana, Niger, Venezuela, and Vietnam.

A UNIDO International Workshop on Ecologically Sustainable Gold Mining and Processing was held in Jakarta/Indonesia in November 1995 and attended by 41 participants from 14 countries, including one participant from Tanzania. Recognizing the necessity for providing advice and technical assistance in order to avoid further mercury pollution, the participants fully endorsed UNIDO's programme and supported the following recommendations:

1. Gold mining on the small and artisanal level should make a valuable contribution to alleviate poverty in developing countries.
2. Since the environmental impacts of this increased activity are considerable, particularly from the widespread use of mercury, a long term strategy for remediation and for regularization of the sector should be developed.

3. The UN system, particularly UNIDO, must play an important role in assisting developing countries in engineering ecologically sustainable development. In the gold mining sector, UNIDO should increase its assistance to developing countries, including policy advice to government, the promotion of low cost, efficient and safer equipment and techniques and the encouragement of support by both miners and the public for solutions to the numerous environmental concerns. The participants endorsed the use of bilateral agreements between developing countries for cooperation in these areas.
4. Legal and financial constraints limit the evolution of the small-scale gold mining sector into formal operations. Attention needs to be given to both legalizing this sector and to creating alternative finance assistance, including linkages with the formal sector, the use of development bank finance and appropriate taxation regimes.
5. UNIDO and other donor community agencies, in cooperation with the governments concerned, should continue and increase their support to developing countries, in particular to the least developed countries, for the development of an orderly and ecologically sustainable small-scale gold mining sector. Such assistance should be directed at and made in conjunction with the needs of the miners working in the field.
6. Women play a major role in artisanal and small-scale gold mining, and special efforts should be made to ensure that they benefit from any assistance given to this sector.
7. Because of the widespread use of child labour in the informal gold mining sector, the relevant governments and agencies should be urged to provide the resources needed to abolish this abuse.

The Workshop gave clear evidence of the high demand for assistance to the informal gold mining sector and supported UNIDO's approach and strategy for the introduction of more efficient gold recovery and cost effective gravity gold concentration methods that displace mercury amalgamation.

Since the issue of damage caused to the environment and human health by mercury pollution due to artisanal gold mining is multifaceted and complex, education, communication of information and technology transfer can be considered as keys for improving the situation. For achieving this, UNIDO is well prepared and experienced in putting together cross-discipline programmes, covering environmental protection, introduction of new technologies and manufacturing, mineral beneficiation as well as integration of women in industry.

In the latter context, UNIDO will make a special effort to ensure that women participate equally in - and benefit equally from - the introduction of new equipment and processing techniques. UNIDO is also counting on women miners to be the most ardent advocates for the alternative technology because of their traditional care-giver roles.

2.1 PROGRAMME STRATEGY

The UNIDO initiative on introducing new technologies for global abatement of mercury pollution has been discussed in detail with the Government of Tanzania during the mission of Project Manager to Tanzania in August 1997. According to these deliberations, the project has to be implemented in two phases:

PHASE 1 will involve training of the trainers which will include amongst others women entrepreneurs in the Lake Victoria Gold Field, mines officers and leaders of miners associations in the area. Training of small-scale miners in the sites will follow this.

PHASE 2 will involve supervision of pilot plant to be financed by the Mineral Sector Development Project No. 2648 - TA. The supervision will include selection of site, evaluation of the gold deposits around the site, economic evaluation of the pilot plant, training of the small-scale miners including women on the protection of the environment and non-use and recycling of mercury, and also training on safe gold extraction practices.

For the institutional arrangements, counterparts will be established in the Ministry of Energy and Minerals (MEM) as the coordinating body/national project owner, and the above-mentioned institutions and associations, with whom the project is to be linked. Together with these counterparts, a work plan and project strategy will be established together with these institutions for introducing new mining equipment and methods, clean technology, education about mercury hazard to local miners and farmers.

The project will have a special outreach approach for female artisanal miners in the introduction of new methods of mining and equipment in a way that ensures their integration into the new mining practices. This will be organized taking into consideration any impediments or special constraints women face due to socio-cultural values or time constraints as a result of their multiple roles. For this purpose, cooperation will be sought from the related women's organizations/associations. The project will also ensure that women miners are trained properly so that they can use newly introduced equipment and technology. The general strategy of the project will be to introduce new technology or equipment that can be produced locally by the mining communities themselves, or by modest fabrication facilities. This will have a significant impact on the sustainability of the programme.

An important objective will be to ensure that such technology and equipment will be environmentally friendly.

The use of video about the new mining techniques and environmental concerns and the menace of mercury will be a useful method for the dissemination of information. TV is widespread through the country, even in remote villages where people assemble daily to watch scheduled features. The evident undivided attention it receives accords with its relatively recent arrival in most places.

Preparation of a film for training and distribution about new mining and processing methods, and a stark propaganda piece from archives graphically defining the mercury problem - the Minamata illness, etc. - should quicken the acceptance of these ideas. The inclusion of video camera, TV, VCR in the equipment list, and a local filmmaker under inputs has this objective.

2.2 IMPLEMENTATION MODALITIES

MEM as umbrella institution and project owner will appoint a National Project Director and a Secretary to the project. Furthermore, it will make available all expertise gained, its archives and personnel for research and will assist through its liaison to the women's associations.

MEM will supervise the activities and monitor introduction of the new technologies as well as the progress of training. It will have a lead role in all technology- and environment-related issues.

The women's association will advise in all women-related issues and monitor the integration of women in all activities of the project. It will encourage women participation in the offered training programme.

All information and expertise related to the social pattern in the country will be made available by MEM and the Women's association. This includes the availability to project personnel of reports and studies, both published and unpublished.

Each counterpart involved will be responsible for the transport of its own personnel and of project equipment.

UNIDO will be responsible for the overall control of the project and will put together the cross-discipline programme involving coordination of technicians of a wide variety of expertise in mineral processing, manufacturing and environment as well as integration of women into industrial development.

For the purpose of project management, a steering committee will be established comprising the MEM, Women's Association and UNIDO. The steering committee will meet every two months to review progress.

3. OBJECTIVES, OUTPUTS AND ACTIVITIES

➤ IMMEDIATE OBJECTIVE I

Identification of the environmental impact of informal gold mining activities and assessment of needs in providing policy advice.

3.1 OUTPUT 1

Report on the environmental impact by the Environmental Expert and assessment of present legal framework governing the sector.

Activities for Output 1

- 3.1.1 Meet officials of Government and mining related institutions and discuss present situation of the environment and health in the informal gold mining areas and assess data of previous studies conducted by World Bank, UNDP and bilateral aid institutions.
- 3.1.2 Verify the compliance of technology applied with the existing Mining Code and analyze effectiveness of the existing environmental regulations.
- 3.1.3 Advise on necessary interactions between government departments, mining industry and research institutions.
- 3.1.4 Prepare a concise report on all findings and data including recommendations.

➤ IMMEDIATE OBJECTIVE 2

To enable artisanal miners including women miners and women entrepreneurs to better understand the general basic concepts of gold mining and ore processing to allow them to operate viable small-scale mining (first phase of training).

3.2 OUTPUT 2

Established training courses for trainers (mines officers, leaders of miners associations, women entrepreneurs) and artisanal miners on introduction of high efficiency clean technology avoiding environmental degradation and health hazards.

Activities for Output 2

- 3.2.1 Identification of appropriate participants from mining areas in Mwanza, Geita, Kahama, Musoma, Tarime, Shingyanga, Kayanga.
- 3.2.2 UNEP to prepare and give lectures on
 - * methodologies for environmental management;
 - * mitigation measures to improve environmental performance;
 - * examples of good practices;
 - * environmental management networks to improve access to information, technologies and solutions.
- 3.2.3 UNIDO to prepare and give lectures on gold prospecting and exploration, covering
 - * principles of prospecting and mineral exploration;

- * simple mapping and map reading;
- * prospecting equipment and their uses;
- * observation of prospecting and exploration methods;
- * practical application of simple techniques of prospecting and exploration;
- * roles of the geologists and geological survey departments in mineral prospecting and exploration;
- * engaging services of professional geologists;
- * assaying and testing of ores and minerals;

3.2.4 UNIDO to prepare and give lectures on small-scale gold mining methods and ore extraction, covering

- * roles of mining engineers and mining departments in mining and ore extraction;
- * mining equipment, tools and machinery;
- * engaging the services of professional mining engineers.

3.2.5 UNIDO to prepare and give lectures on sustainable technology in mineral processing of gold ores, covering

- * principles of mercury-free ore dressing and mineral processing;
- * equipment for mercury recycling;
- * reagents and chemicals;
- * flowsheets;
- * roles and services offered by metallurgists and metallurgical laboratories;
- * engaging services of professional metallurgists.

3.2.6 UNIDO to prepare and give lectures on mineral marketing and record/book keeping, covering

- * mineral marketing practices, laws and regulations;
- * simple book keeping and cash flow preparation.

3.2.7 Work distribution among cooperating mining group members.

3.3 OUTPUT 3

Introduction of improved gold concentrating methods through supervision and operation of pilot plant financed by World Bank Mineral Sector Development Project No.2648 (Second phase of training).

Activities for Output 3

- 3.3.1 Identification and selection of target project site.
- 3.3.2 Work distribution among cooperating mining group members.
- 3.3.3 Introduce recovery/recycling methods for mercury by using retorts.

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- 3.3.4 Adoption of competitive mechanical alternatives to mercury amalgamation.
 - 3.3.5 Education and training of miners in mechanical and processing aspects of mercury-free technology.
 - 3.3.6 Training of local manufacturers in production of high efficiency equipment in project areas (mostly carpenters and local iron smelter).
 - 3.3.7 Assistance in developing transportable equipment ensembles for medium-scale co-operatives.
 - 3.3.8 Assistance in developing domestically fabricated fine gold concentrators.
 - 3.3.9 Demonstration of the new equipment to different groups of miners, in particular under the aspect of integration of women into the working groups.
 - 3.3.10 Video production on application of improved gold concentrating methods.
 - 3.3.11 Distribution of training video to mining groups for enhancing replication of experience.

4. UNIDO INPUTS

Budget line/Functional Title		Total		1997		1998		1999	
		m/m	US\$	m/m	US\$	m/m	US\$	m/m	US\$
11-01	UNEP Trainer	2.5	20,000.00	0.6	5,000.00	1.9	15,000.00		
11-02	Maintenance Engineer	0.4	4,000.00			0.2	2,000.00	0.2	2,000.00
11-03	Environmental Expert	1.2	12,467.00	1.2	12,467.00				
11-99	Sub-Total	4.1	36,467.00	1.8	17,467.00	2.1	17,000.00	0.2	2,000.00
15-00			8,000.00				4,000.00		4,000.00
16-00			14,269.00		6,189.00		8,080.00		
17-01		14.0	35,000.00	1.0	2,500.00	9.0	22,500.00	4.0	10,000.00
17-02		14.0	35,000.00	1.0	2,500.00	9.0	22,500.00	4.0	10,000.00
17-03		14.0	35,000.00	1.0	2,500.00	9.0	22,500.00	4.0	10,000.00
17-04		8.0	20,000.00	1.0	2,500.00	3.0	7,500.00	4.0	10,000.00
19-99	Sub-Total	54.1	183,736.00		33,656.00		104,080.00	16.2	46,000.00
21-00			20,000.00				20,000.00		
31-00			50,000.00				35,000.00		15,000.00
42-00			62,500.00		50,000.00		12,500.00		
51-00			10,184.00		184.00		5,000.00		5,000.00
99-99	Project Total	54.1	326,420.00	5.8	83,840.00	32.1	176,580.00	16.2	66,000.00

ANNEX 1

List of Equipment

Field equipment (non-expendable)

such as field vehicle, computer, fax machine, copy machine, mercury retorts.

Total US\$ 62,500

ANNEX 2

JOB DESCRIPTIONS

Post 11-01

Post 11-02

Post 11-03

Post 17-01

Post 17-02

Post 17-03

Post 17-04

JOB DESCRIPTION
TF/URT/94/G10
Post 11-01

Post Title: UNEP Expert on environmental management

Duration: 2.5 m/ms (breakdown: 1.0 m/m home based work, 0.5 m/m site visit, 1.0 m/m teaching in the field)

Duty station: Selected gold mining areas in Tanzania

Purpose of project: Introducing new technologies for abatement of global mercury pollution

Duties: Under the direction of the National Project Coordinator, and in cooperation with national personnel, the expert will be responsible for the following duties:

1. Prepare and give lectures on:

- * methodologies for environmental management;
- * mitigation measures to improve environmental performance;
- * examples of good practices;
- * environmental management networks to improve access to information, technologies and solutions.

Qualification:

Senior Mining Engineer with experience in environmental management of mining sites.

Background and Justification:

Mercury is one of the most toxic substances in the world causing significant damage to the environment and to the health of people who handle it. Mercury is absorbed by the human organism through drinking water, food or breathed air. Mercury is used most by artisanal gold miners. Their activities provide income to the world's poorest populations and ethnic minorities; a great majority of the miners being women and children. For every gram of gold recovered, about two grams of mercury are released into the environment - often resulting in the death of men, women and children and in a permanently ruined habitat. The relevant simplicity and effectiveness of the technology, known as amalgamation, mask its dangers. This process can be improved with procedures using inexpensive and highly efficient devices which can be manufactured locally at low cost.

The objective of the programme is to replace mercury amalgamation with new technology while improving the income of the miners through more efficient recovery

and to provide policy advice on the regulation of artisanal gold mining with due consideration for gender issues.

The primary target beneficiaries will be artisanal miners - men and women alike. The secondary beneficiaries will be governments, local institutions and the society at large due to the very nature and extent of the damage caused by artisanal mining.

The activities will mainly be directed towards the introduction of safe and high-yield extraction methods that could preempt the use of mercury - i.e. introduction of production of equipment for the new technology and its dissemination; training of local manufacturers; training of miners for competitive alternatives to mercury amalgamation; awareness creation on the protection of the environment as well as policy advice to governments and local institutions.

JOB DESCRIPTION

TF/URT/94/G10

Post 11-02

Post Title: Maintenance Engineer for servicing pilot plant for mercury-free gold extraction

Duration: 0.4 m/m

Duty station: Selected gold mining areas in Tanzania

Purpose of project: Introducing new technologies for abatement of global mercury pollution

Duties: In cooperation with the National Project Coordinator and the other experts, the Maintenance Engineer is responsible for the smooth operation of the mineral processing demonstration unit financed under Mineral Sector Development Project No. 2648 – TA (World Bank financed project) . In particular the duties include:

1. Assist National Project Coordinator in preventive and active maintenance of mineral processing plant.
2. Prepare electrical and mechanical maintenance schedules.
3. Train a crew of mechanics and electricians at the demonstration pilot plant.
4. Propose a set of tools and spare parts, and exert control on stock keeping of these items.
5. Preparation of maintenance manuals for equipment.
6. Submission of Terminal Project report.

Qualification:

Senior Mining Engineer with broad experience in maintenance of heavy and electrical equipment.

Background and Justification:

Mercury is one of the most toxic substances in the world causing significant damage to the environment and to the health of people who handle it. Mercury is absorbed by the human organism through drinking water, food or breathed air. Mercury is used most by artisanal gold miners. Their activities provide income to the world's poorest populations and ethnic minorities; a great majority of the miners being women and children. For every gram of gold recovered, about two grams of mercury

are released into the environment - often resulting in the death of men, women and children and in a permanently ruined habitat. The relevant simplicity and effectiveness of the technology, known as amalgamation, mask its dangers. This process can be improved with procedures using inexpensive and highly efficient devices which can be manufactured locally at low cost.

The objective of the programme is to replace mercury amalgamation with new technology while improving the income of the miners through more efficient recovery and to provide policy advice on the regulation of artisanal gold mining with due consideration for gender issues.

The primary target beneficiaries will be artisanal miners - men and women alike. The secondary beneficiaries will be governments, local institutions and the society at large due to the very nature and extent of the damage caused by artisanal mining.

The activities will mainly be directed towards the introduction of safe and high-yield extraction methods that could preempt the use of mercury - i.e. introduction of production of equipment for the new technology and its dissemination; training of local manufacturers; training of miners for competitive alternatives to mercury amalgamation; awareness creation on the protection of the environment as well as policy advice to governments and local institutions.

JOB DESCRIPTION

TF/URT/94/G10

Post 11-03

Post Title: Consultant on Environmental Management of Small-scale and Artisanal mining sites

Duration: 1.2 m/ms

Date required: 25 February 1997

Duty Station: Sub-regional Training Workshop in Georgetown/Guyana (25 February - 7 March 1997), rest home based; 2-day debriefing visit to Vienna.

Purpose of Project: Preparatory work and reconnaissance survey for the implementation of training programmes in environmental management of small scale and artisanal mining sites in Tanzania.

Duties:

The Consultant will be expected to:

1. Prepare and deliver workshop presentations on small-scale and artisanal mining.
2. Prepare training material needed to guide the discussions of participants following the subjects developed (under UNIDO contract SI/VEN/94/801/11-53) and format this into a training module. Some of the modules will later be incorporated in a training manual being developed on small-scale and artisanal mining which will also be used in Tanzania.
3. Design and test out session formats for group work sessions, field visits, discussion forum, and country presentations, as part of a larger workshop curriculum.
4. Develop a field demonstration exercise on technology transfer which will be implemented during the training workshop. *[The technology used for gold extraction by the Yucon placer miners (Canada) will be demonstrated in the field exercise. This technology is based on gravity separation techniques,- no cyanide or mercury is used for the recovery of the gold]*
5. Develop a procedure for training administrators in ENTA -Environmental Technology Assessment, adapted from material already produced by UNEP.
6. Establish links with participants to develop networking possibilities for future workshops and interregional/global programmes on small-scale and artisanal mining and co-operate with other technical resource persons on the technology transfer field demonstrations.

7. Provide an environmental review and a description of social impact assessment issues at small-scale and artisanal mining sites during field visits to the small scale mining camps.
8. Compile the above into a preliminary training package for testing and field trials at an upcoming UNDP/UNEP workshop in Guyana. Based on this trial, a final training package will be prepared for implementation in UNIDO project in Tanzania and elsewhere.
9. The consultant will provide UNIDO with a written copy of all presentations mentioned in point 1, as well as the accompanying overheads/slides used during the presentations. The background material distributed at the course should also be provided.

Qualification:

Expert in Environmental Management with previous experience in UNIDO and UNEP programmes in mining, international environmental conventions and treaties as well as environmental regulations governing mining activities. Experience in teaching, developing training programmes and work experience in low income developing countries would be desirable.

Language: English/Spanish

Background:

The interrelationship between environmental and socioeconomic forces means that a number of general trends will influence the evolution of environmental issues, and the way they can be resolved at the global level. This is particularly true for the small-scale and artisanal mining operations where the population growth, among other social factors, will increase pressure for these operations often to the detriment of the environment.

The issues of land degradation and mercury pollution in particular are acute in this subsector, with the [after being a continuous concern to decision-makers and the international community, due to the long-term health problems it could cause. A recent example is in the Diwalwal region in the Phillippines where mining operations have been blamed for mercury poisoning of at least 12 school children.

Systematic training and education for this subsector is considered by many experts working in this field as one of the most effective tools to combat the problem and will therefore be of crucial importance in order to curb some of these detrimental impacts in the future.

A 1994 survey (UNEP) of mining schools around the world found that environmental curricula are generally poorly developed in most schools, and consequently newly graduating mining engineers and geologists are not informed about environmental issues. The awakening environmental consciousness is now being encouraged. Training

material is being prepared and curriculum advice is provided to assist such schools to upgrade the formal teaching programmes for mining engineers.

Small-scale mining issues have suffered the same fate and they might be in a worst position considering the long time neglect of this sub-sector by local authorities, international agencies, donors and development agencies. So far little has been done to bring training in the small-scale and artisanal mining sub-sector on an equal footing with large-scale mining.

In an attempt to fill this gap, a joint initiative between UNIDO and UNEP IE, aims to develop an outline of a standard training module for the Environmental Management of Small-scale and Artisanal Mining within the framework of UNIDO's **"Introducing new technologies for abatement of global mercury pollution"** programme. The module is expected to be used and field tested at several training workshops and become a standard training manual which could be used for training courses and curriculum development purposes on small-scale and artisanal operations. A training workshop in Guyana (see also annex 1), which includes many small-scale and artisanal mining issues on the agenda, will be used as a platform to collect further information and to discuss the environmental problems resulting from these operations with several of the participants of the neighboring countries.

The training programme for Tanzania will directly benefit from this undertaking. The information gathered would be used for the upcoming training activity in small-scale and artisanal mining in Tanzania. This training activity, is a component of the UNIDO project on Artisanal mining in Tanzania which is financed by the Government of Japan. The collected training material in the Guyana workshop would also be used and further adapted to fit into the local situations of the remote areas in Tanzania. Under this undertaking in Guyana, cultural and other information on social factors which would allow further comparison with the African situation during the implementation of training component of the Tanzania project would also be collected.

It would also allow a further assessment of these factors influence on technology transfer issues and to which extent they are playing a role in solving the environmental problems of this subsector with a view of improving environmental performance of the small and artisanal mining operations.

EXPECTED OUTPUTS:

Integrated training curriculum, including:

- training modules on various subjects
- lecture notes and audiovisuals
- trainer support material and notes
- model workshop programme

JOB DESCRIPTION
TF/URT/94/G10
Post 17-01

Post Title: National Project Coordinator for introducing new technologies for abatement of mercury pollution.

Duration: 14.0 m/ms (= 2.0 m/ms for Phase I and 12.0 m/ms for Phase II)

Duty station: Selected gold mining areas in Tanzania

Date required: As soon as possible

Purpose of

project: Introducing new technologies for abatement of global mercury pollution and introduction of high efficiency clean technology with improved gold recovery.

Phase I: Preparation and execution of training programme for Phase I (training of trainers, women entrepreneurs, artisanal miners).

Phase II: Operation and supervision of demonstration unit.

Duties: In cooperation with Project Director of Mineral Sector Development Project No. 2648 – TA (World Bank financed project) and other experts, the National Project Coordinator is responsible for the overall direction of the project, including the timely and technically correct execution of project activities and outputs. In particular, the duties include:

1. Prepare, coordinate and supervise training activities.
2. Compile and review all available data on Project area, including extensive site inspections and detailed planning of field work.
3. Establish formal coordination links and working relationships with associates in all ministries, institutions, offices designed to participate in Project outputs.
4. Supervision and quality control of all Project activities, design pilot testing, development of alternative high-efficiency artisanal mining and processing equipment that avoid mercury amalgamation and environmental damage, training and transfer of new mining/beneficiation methods to targeted population.
5. Submission of monthly reports and Terminal Project Reports both for Phase I and Phase II.

Qualification:

Senior Geologist /Mining Engineer with experience in coordinating minerals related projects, or M.Sc. holder in field of earth sciences.

Background and Justification:

Mercury is one of the most toxic substances in the world causing significant damage to the environment and to the health of people who handle it. Mercury is absorbed by the human organism through drinking water, food or breathed air. Mercury is used most by artisanal gold miners. Their activities provide income to the world's poorest populations and ethnic minorities; a great majority of the miners being women and children. For every gram of gold recovered, about two grams of mercury are released into the environment - often resulting in the death of men, women and children and in a permanently ruined habitat. The relevant simplicity and effectiveness of the technology, known as amalgamation, mask its dangers. This process can be improved with procedures using inexpensive and highly efficient devices which can be manufactured locally at low cost.

The objective of the programme is to replace mercury amalgamation with new technology while improving the income of the miners through more efficient recovery and to provide policy advice on the regulation of artisanal gold mining with due consideration for gender issues.

The primary target beneficiaries will be artisanal miners - men and women alike. The secondary beneficiaries will be governments, local institutions and the society at large due to the very nature and extent of the damage caused by artisanal mining.

The activities will mainly be directed towards the introduction of safe and high-yield extraction methods that could preempt the use of mercury - i.e. introduction of production of equipment for the new technology and its dissemination; training of local manufacturers; training of miners for competitive alternatives to mercury amalgamation; awareness creation on the protection of the environment as well as policy advice to governments and local institutions.

JOB DESCRIPTION
TF/URT/94/G10
Post 17-02

Post Title: Mineral Processing Expert

Duration: 14.0 m/ms (= 2.0 m/ms for Phase I and 12.0 m/ms for Phase II)

Duty station: Selected gold mining areas in Tanzania

Date required: As soon as possible

Purpose of

of Project: Introducing new technologies for abatement of global mercury pollution and introduction of high efficiency clean technology with improved gold recovery.

Phase I: Preparation and execution of training programme for Phase I (training of trainers, women entrepreneurs, artisanal miners).

Phase II: Operation and supervision of demonstration unit.

Duties: Under the direction of the National Project Coordinator, and in cooperation with national personnel, the expert will be responsible for the following duties:

1. Preparation and execution of training programme for Phase I (training of trainers, women-entrepreneurs, artisanal miners) and Phase II (Operation of Demonstration unit for mercury-free technology) covering the following topics:
 - Prepare and give lectures on mineral processing of gold ores, covering
 - * principles of ore dressing and mineral processing
 - * equipment for mineral processing
 - * reagents and chemicals
 - * flowsheets
 - * roles and services offered by metallurgists and metallurgical laboratories
 - * engaging services of professional metallurgists
 - Prepare and give lectures on health and safety, covering
 - * hazards in mining and ore processing
 - * first aid
 - Prepare and give lectures on pollution control and environmental protection, covering
 - * principles of mine wastes and tailings disposal
 - * hazardous chemicals and reagents with focus on mercury
 - * pollution control and environmental protection rules and regulations

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- Prepare and give lectures on mineral marketing and record/book keeping, covering
 - * mineral marketing practices, laws and regulations
 - * simple book keeping and cash flow preparation
 - 2. Setup of work facilities and equipment.
 - 3. Development/testing of high efficiency gold concentration/processing equipment to replace inefficient artisanal methods.
 - 4. Assist development of domestic fabrication of processing and gold concentrating equipment.
 - 5. Train national personnel in equipment handling methods and assist in the adoption of competitive mechanical alternatives that replace mercury amalgamation.
 - 6. Demonstrate the operation of new equipment to different group of miners, in particular under the aspect of integration of women into the working groups.
 - 7. Preparation of operation manuals for equipment.
 - 8. Expert will contribute to preparation of monthly reports and project summary reports as requested.

Qualification:

Senior Mining or Mineral processing Engineer with a background in gold mining and gold beneficiation equipment.

Background and Justification:

Mercury is one of the most toxic substances in the world causing significant damage to the environment and to the health of people who handle it. Mercury is absorbed by the human organism through drinking water, food or breathed air. Mercury is used most by artisanal gold miners. Their activities provide income to the world's poorest populations and ethnic minorities; a great majority of the miners being women and children. For every gram of gold recovered, about two grams of mercury are released into the environment - often resulting in the death of men, women and children and in a permanently ruined habitat. The relevant simplicity and effectiveness of the technology, known as amalgamation, mask its dangers. This process can be improved with procedures using inexpensive and highly efficient devices which can be manufactured locally at low cost.

The objective of the programme is to replace mercury amalgamation with new technology while improving the income of the miners through more efficient recovery and to provide policy advice on the regulation of artisanal gold mining with due consideration for gender issues.

The primary target beneficiaries will be artisanal miners - men and women alike. The secondary beneficiaries will be governments, local institutions and the society at large due to the very nature and extent of the damage caused by artisanal mining.

The activities will mainly be directed towards the introduction of safe and high-yield extraction methods that could preempt the use of mercury - i.e. introduction of production of equipment for the new technology and its dissemination; training of local manufacturers; training of miners for competitive alternatives to mercury amalgamation; awareness creation on the protection of the environment as well as policy advice to governments and local institutions.

JOB DESCRIPTION
TF/URT/94/G10
Post 17-03

Post Title: Expert in Mining Geology, Mining Law for conducting training courses of women-miners in basic concepts of small-scale gold mining

Duration: 14.0 m/ms (= 2.0 m/ms for Phase I and 12.0 m/ms for Phase II)

Duty station: Selected gold mining areas in Tanzania

Date required: As soon as possible

Purpose of

project: Introducing new technologies for abatement of global mercury pollution and introduction of high efficiency clean technology with improved gold recovery.

Phase I: Preparation and execution of training programme for Phase I (training of trainers, women entrepreneurs, artisanal miners).

Phase II: Operation and supervision of demonstration unit.

Duties: The duties comprise preparation and execution of a 2-month training programme for Phase I and a 12-month training programme for Phase II covering the following tasks:

1. Prepare and give lectures on mining rights acquisition and maintenance, covering
 - * concepts of mineral property ownership
 - * Understanding and complying with mining laws and regulations
 - * Registering of mining claims
 - * Assessment works and obligations
 - * Roles and services offered by mining commissioners or other government offices issuing of mining rights
2. Prepare and give lectures on gold prospecting and exploration, covering
 - * principles of prospecting and mineral exploration
 - * simple mapping and map reading
 - * prospecting equipment and their uses
 - * observation of prospecting and exploration methods
 - * practical application of simple techniques of prospecting and exploration
 - * roles of the geologists and geological survey departments in mineral prospecting and exploration
 - * engaging services of professional geologists
 - * assaying and testing of ores and minerals
3. Prepare and give lectures on small-scale gold mining methods and ore extraction, covering

- * roles of mining engineers and mining departments in mining and ore extraction
- * mining equipment, tools and machinery
- * engaging the services of professional mining engineers

Qualification:

An experienced geologist with background in gold exploration, evaluation of gold deposits and a knowledge on administering the Mining Law of Tanzania.

Background and Justification:

Mercury is one of the most toxic substances in the world causing significant damage to the environment and to the health of people who handle it. Mercury is absorbed by the human organism through drinking water, food or breathed air. Mercury is used most by artisanal gold miners. Their activities provide income to the world's poorest populations and ethnic minorities; a great majority of the miners being women and children. For every gram of gold recovered, about two grams of mercury are released into the environment - often resulting in the death of men, women and children and in a permanently ruined habitat. The relevant simplicity and effectiveness of the technology, known as amalgamation, mask its dangers. This process can be improved with procedures using inexpensive and highly efficient devices which can be manufactured locally at low cost.

The objective of the programme is to replace mercury amalgamation with new technology while improving the income of the miners through more efficient recovery and to provide policy advice on the regulation of artisanal gold mining with due consideration for gender issues.

The primary target beneficiaries will be artisanal miners - men and women alike. The secondary beneficiaries will be governments, local institutions and the society at large due to the very nature and extent of the damage caused by artisanal mining.

The activities will mainly be directed towards the introduction of safe and high-yield extraction methods that could preempt the use of mercury - i.e. introduction of production of equipment for the new technology and its dissemination; training of local manufacturers; training of miners for competitive alternatives to mercury amalgamation; awareness creation on the protection of the environment as well as policy advice to governments and local institutions.

JOB DESCRIPTION
TF/URT/94/G10
Post 17-04

Post Title: National WID expert

Duration: 8.0 m/ms (2 m/ms in Phase I and 6 m/ms in Phase II)

Duty station: Selected gold mining areas in Tanzania

Date required: As soon as possible

Purpose of

project: Introducing new technologies for abatement of global mercury pollution and introduction of high efficiency clean technology with improved gold recovery.

Phase I: Preparation and execution of training programme for Phase I (training of trainers, women entrepreneurs, artisanal miners).

Phase II: Operation and supervision of demonstration unit.

Duties: Under the direction of the National Project Coordinator and in cooperation with national personnel, the expert will undertake the following duties:

1. Meet representatives of women's associations to discuss the status and situation of women engaged in gold mining, share of women and their contribution to the incomes of the households, type of work they are carrying out in the mining process and their working conditions.
2. Meet concerned women in all small-scale and artisanal mining areas of Tanzania (during Phase I in Lake Victoria Goldfields only, during Phase II in all other gold mining areas) to investigate their actual living and working conditions and the need to let children take part in the income generation.
3. Explain the project to the above persons and discuss how it can serve the women. Make recommendations to the project staff on how the project can better address women's problems and can better integrate them into the mining activities they are involved in.
4. Prepare reports on all findings and information/data, including recommendations during project implementation so that problems identified can be addressed to the project. The expert is also required to prepare a concise report at the end of the project.

Qualification: Women with a Diploma or university degree in accounts. Experience in training local women and knowledge on the operation of small-scale miners.

Background and Justification:

Mercury is one of the most toxic substances in the world causing significant damage to the environment and to the health of people who handle it. Mercury is absorbed by the human organism through drinking water, food or breathed air. Mercury is used most by artisanal gold miners. Their activities provide income to the world's poorest populations and ethnic minorities; a great majority of the miners being women and children. For every gram of gold recovered, about two grams of mercury are released into the environment - often resulting in the death of men, women and children and in a permanently ruined habitat. The relevant simplicity and effectiveness of the technology, known as amalgamation, mask its dangers. This process can be improved with procedures using inexpensive and highly efficient devices which can be manufactured locally at low cost.

The objective of the programme is to replace mercury amalgamation with new technology while improving the income of the miners through more efficient recovery and to provide governments policy advice on the regulation of artisanal gold mining with due consideration for gender issues.

The primary target beneficiaries will be artisanal miners - men and women alike. The secondary beneficiaries will be governments, local institutions and the society at large due to the very nature and extent of the damage caused by artisanal mining.

The activities will mainly be directed towards the introduction of safe and high-yield extraction methods that could preempt the use of mercury - i.e. introduction of production of equipment for the new technology and its dissemination; training of local manufacturers; training of miners for competitive alternatives to mercury amalgamation; awareness creation on the protection of the environment as well as policy advice to governments and local institutions.