



Beratung in Entwicklungsländern GmbH

Mercury and Cyanide related professional experiences of Projekt-Consult GmbH

The importance of small-scale mining in developing countries around the world is not to be underestimated. Small-scale mining as a poverty driven activity includes enterprises of many different kinds, ranging from individual miners, adhoc groupings, family businesses and mining co-operatives to mechanised, well organised, market-oriented companies. Except for the last mentioned types, most small-scale mining can be assigned to the informal sector.

These enterprises often operate without legal mining titles. In many countries general mining legislation makes no provisions for small-scale mining, so that there is little or no scope for legalising such activity. Nevertheless, government authorities and supervisory bodies tend to tolerate small-scale mining because of the social situation of the miners, the difficulties to control the sector and the fact, that, at least in some countries, the miners pay levies.

Small-scale gold mining operations very often use great amounts of mercury as a processing reagent. In this amalgamation process an amalgam is formed by alloying the gold in the ore sludge with mercury. The amalgam is then separated into mercury vapour and gold by a subsequent burning process. In both process steps, amalgamation and burning the miners loose as much as 1 to 40 times of mercury to the environment in relation to the extracted gold weight.

Projekt-Consult looks back on a professional experience with mercury and cyanide of over 20 years:

Colombia: Pilot measures for Tools for Mining

In the late 80's, within the framework of the GTZ-supported Tools for Mining project, we became aware of the enormous environmental and health challenges generated by the wide-spread use of the amalgamation process in artisanal and small-scale mining. Within pilot projects in Colombia, first technical means to reduce mercury emissions from the process and to replace the open mercury cycle, have been successfully implemented in Southern Colombia.

Brazil: Mercury contamination of the rivers Tapajós and Madeira, Amazonia

From 1994 to 1997 Projekt-Consult GmbH was implementing a larger project on mercury contaminations due to gold mining in the basins of the rivers Tapajós and Madeira in the Brazilian Amazon region, which was funded by the European Union. It consisted of a broad component to assess and document the environmental impacts of mercury in soils, air, water and biota (especially river fish). Local laboratory infrastructure was established in the area, local experts trained, and extensive monitoring programs performed. Parallel to this, together with the local partners, the Association of Gold Miners of the Tapajós and the Secretary of Mining and Environment, Projekt-Consult

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GmbH developed, tested and disseminated environmentally friendly alternative techniques, which were at the reach of the artisanal miners.

Subsequently, from 1993 the Swiss Government (SDC) through the Global Environment Funding line, supported three major projects in the Andean countries Ecuador, Bolivia and Peru which were all focussing on the reduction of mercury and cyanide related impacts in and through small-scale mining by the transfer of simple techniques to reduce mercury pollution, training and awareness building, organisational changes and co-ordinated efforts of Governments, NGO, producers and service suppliers. This helped to overcome not only the environmental problems but as well the poor economical and social situation of the artisanal and small-scale miners. The projects led to encouraging results regarding the upgrading of environmental performance in the informal sector including significant contribution in mitigating mercury emissions.

Ecuador: Mining without contamination (PMSC)

The project "Mining without Contamination" provided technical and environmental assistance to the small-scale-miners in the region of Zaruma in Southern Ecuador, where the activity of about 10.000 informal miners originated serious environmental and health hazards for the agricultural communities located downstream the mining area.

The environmental and health hazards have been scientifically established by the extensive monitoring of mercury and cyanide in the environment and by medical and toxicological assessments of miners, members of mining communities and a comparison with non-affected population (in cooperation with medical doctors and mercury toxicology and health specialists).

Based on an active dialogue with miners and mining-environmental authorities a new concept to resolve the actual conflicts has been developed by the project. The strategy, which shall allow an immediate implementation of environmental measures in close cooperation with the miners, consists in cost-sharing and responsibility-sharing by collective environmental assessment and was denominated "Plan ECO+" (Estudios Colectivos de Impacto y Manejo Ambiental). This approach was thoroughly studied and finally accepted in form of a ministerial decree in 1994, and opened the possibility to include all technically similar enterprises in a certain zone in only one, collective but regional EIA.

Since then about 40 enterprises have successfully been legalised and assisted in the upgrading of their environmental performance by the establishment and implementation of environmental management plans, completing more than 170 individual environmental measures. The implemented techniques contribute in their majority to a significant reduction of mercury, cyanide, nitric-acid, and heavy-metal emissions to the ecosystem. The outstanding success of the model "ECO+" inspired legislative changes in Ecuador, Bolivia and Brazil, where during the last years collective EIA's for the small-scale mining sector were integrated in the mining/environmental legislation.

Bolivia: Program MEDMIN

Another successful example for the implementation of environmental projects in small-scale mining is the "Environmental Integrated Management in Small-Scale Mining" (MEDMIN) program, which began its activities in Bolivia in April of 1994. MEDMIN is an environmental protection program which functioned thanks to an agreement between the Bolivian Government through the Ministry of Sustainable Development and Planning and the Swiss Government through the Swiss Agency for Development and Cooperation (SDC).

The program lasted six years till March 1999. From April 1999 until end of 2002 the program's activities were carried out by the new founded MEDMIN Foundation www.medmin.org , still with significant support from the Swiss Government and Projekt-Consult GmbH. Until now the foundation has gained its full economic, institutional and professional sustainability.

Approximately 500,000 people live directly or indirectly from small-scale mining in Bolivia. This causes serious damage to the environment considering the archaic work methods used, which affect the miners as well as their families and all the population in the mining centres. Among the serious damages caused to the environment, there are:

- Mercury emissions caused by gold mining.
- Siltation and the destruction of landscape caused by alluvial mining.
- Water contamination caused by emissions of tailings from concentration plants.
- Uncontrolled acid water drainage from galleries, tailings and abandoned mines.

At the target group level environmental technologies are implemented in direct collaboration with mining companies and co-operatives, and are carried out in co-ordination with NGOs, universities and governmental organisations responsible for the mining/environmental sector.

A decrease of environmental problems in small-scale mining has been achieved through an integrated and holistic approach. Only individual techniques or technical concepts which also offer economic and social advantages to the artisanal and small-scale miners can be considered successful. A basis for the sustainable impact of MEDMIN is the fusion of positive effects for the economy as well as for the ecology.

In gold mining MEDMIN works in the departments of La Paz and Oruro and in the region of San Simón in the Department of Beni

<http://www.oit.org/public/english/dialogue/sector/papers/goldmine/130e1.htm> .

This work is concentrated on the following order of tasks:

- The reduction of the use of mercury for the concentration of gold and of mercury emissions linked to this process
- The simultaneous recuperation of environmentally harmful sulphides, with a content of gold as marketable subproduct
- The adequate treatment of tailings and the purification of processing waters
- Monitoring

This includes the development and testing of methods, techniques, instruments, equipment and materials, the elaboration and dissemination of information material, videos, bulletins, and the carrying out of seminars and workshops for the target groups and for the representatives of the institutions and authorities involved, as well as the training and specialisation of the Bolivian technical personnel.

The methods and the equipment used are verified and tested thoroughly together with the miners, in what refers to the conservation of the environment as well as to its practical application and its profitability, before propagating its use. Priority is given to available local technology over imported technology.

In approximately 50 co-operatives and small enterprises the processing plants were rebuilt and modified completely in order to avoid the use of mercury in an open circuit. As a main result concerning an external evaluation the mercury emissions in the small-scale mining sector have been reduced so far in more than 15 tons per year in Bolivia through the application of these measures and the use of the almost 250 retorts sold to date.

One major achievement was the solution of conflict cases where amalgamating gold mines were operating in newly established National Parks. Both, from a legal point of view as well as with financially supported programmes to substitute the open cycle

amalgamation and continuous monitoring, these conflicts have been solved to the full satisfaction of the Government.

MEDMIN is -together with the Ecuador project- the first project on a world level which has been successful in reducing significantly mercury emissions in small-scale mining. Due to the implementation of these measures, there are also positive results in improving the productivity of the small operations through an increase of mineral recovery rates between 20 - 35%.

Peru: Integrated Environmental Management of Small-Scale Mining (GAMA)

Since early 1999 the Swiss Government began funding preparatory works on a third project dedicated to integrated environmental management in the small-scale mining sector in Peru. Counterpart of the project, which started in January 2000 is the Ministry of Energy and Mines. Building up upon the experiences from Ecuador and Bolivia, the project still supports public and private initiatives and NGO's to serve as professional and qualified actors in the environmental dialogue between producers, the communities and authorities www.gama-peru.org.

Goal of the project is to achieve a contribution to the sustainable development in the Peruvian small-scale mining regions and of the small-scale mining sub-sector. This was reached through a simultaneous and complementary intervention on macro- and micro-level. Demonstrative results on micro-level (in the pilot-regions Ica, Arequipa, Ayacucho and Puno) served as justification for an improvement of the general legal conditions for the small-scale mining (macro-level). These improved conditions, from which the entire sub-sector benefited, established incentives for the formalisation and compliance with appropriate environmental standards. In order to reach evident improvement of the environmental situation in the small-scale mining areas, the project pursued an integral approach, that comprises organisational, social, health, legal and technical aspects in complementary form.

From the technical and environmental point of view, the development of practical solutions to reduce mercury emissions - which reach record-levels of up to 750 grams mercury per ton of ore, due to "neolithic" mineral processing technology - had uppermost priority for the project. Sustainable technical solutions are still implemented successfully.

Mongolia: Support to Artisanal Mining (SAM)

In order to benefit from these Latin American experiences, SDC contracted our company to design the implementation of an artisanal mining support program in Mongolia. From mid 2005 until the end of 2006 Projekt-Consult GmbH was implementing the orientation phase of the SAM project, which included the outline of program elements to substitute the indiscriminate use of mercury by the artisanal miners. The project was handed over to MRPAM and SDC for further implementation.

In addition, Projekt-Consult GmbH has implemented and is implementing a large number of projects related to artisanal gold mining and its environmental challenges. Currently, projects with strong focus on institutional support to manage socially and environmentally responsible artisanal and small-scale mining, are implemented in Senegal and Papua New Guinea, both on behalf of the European Union.

The major projects of our company over the last 15 years, are systematically presented in the attached reference list.

As a "by-product" these projects, 1997 Projekt-Consult GmbH took leadership in the creation of the "mercury network" as an Internet-based platform for information interchange about mercury, small-scale mining and development issues among 70 experts from 20 countries worldwide. With the management of this network, Projekt-Consult GmbH contributed considerably to the global discussion on mercury related health and environmental issues.

On the level of the Andean states, this network was then replaced by the GECO-platform <http://geco.mineroartesanal.com/>, a platform for knowledge management and interchange which was also established and is managed by Projekt-Consult GmbH. It has a strong focus on amalgamation and mercury related issues.

On the global level, the experiences of Projekt-Consult GmbH have been requested by the Association of Responsible Mining (ARM), where our experts contributed in the definition of the standard zero, a standard for fair traded gold which implies conflict-free exploitation at the origin. Hereby, the environmentally responsible manipulation of mercury and cyanide is one of the key essentials.

Finally, Projekt-Consult GmbH is contributing regularly to the community and small-scale mining network (CASM) hosted by the World Bank and was responsible for artisanal and small-scale mining global report of the MMSD (Mining, Minerals and Sustainable Development) Initiative.

Much of the experiences with the monitoring, toxicology and reduction of mercury has been disseminated and published in books and papers. The most important books prepared by our team members are:

Priester, Michael/Hentschel, Thomas: Small-Scale Gold-Mining. Processing Techniques in Developing Countries. GATE, Vieweg-Verlag Braunschweig 1992, ISBN 3-528-02064-4.

Priester, Michael/Hentschel, Thomas/Benthin, Bernd: Pequeña Minería - Técnicas y Procesos para la pequeña minería en países en desarrollo. GATE, Vieweg-Verlag Braunschweig 1992, ISBN 3-528-02066-0.

Priester, Michael/Hentschel, Thomas/Benthin, Bernd: Tools for Mining. Techniques and Processes for Small Scale Mining. Vieweg-Verlag Braunschweig 1993, ISBN 3-528-02077-6.

Wotruba, H./ Hruschka, F./Hentschel, T./Priester, M.: Manejo ambiental en la pequeña minería, MEDMIN, COSUDE, La Paz, Bolivien 1998, ISBN 3-905299-71-7

Wotruba, H./ Hruschka, F./Livan, K./Hentschel, T./Priester, M.: Environmental Management in Small-Scale Mining, MEDMIN, CASM, SDC, La Paz, Bolivia 2005, ISBN 3-905399-71-7