# CREATING A SUSTAINABLE ARTISANAL AND SMALL-SCALE GOLD MINING SECTOR

## Case Study: Portovelo, Ecuador

**A mineral processing plant is constructed to educate and train artisanal miners in cleaner techniques for gold extraction.**

### Existing Process

Artisanal miners use relatively primitive and inefficient techniques to extract gold that include improper milling, poor concentration techniques and/or whole ore amalgamation with cyanide leaching of contaminated tailings. Gold recovery is greatly reduced while excessive amounts of mercury are released into the environment.

### Intervention

A coalition of government officials, processing center owners, engineering experts and foreign investors collaborated in the development of a demonstration plant in Portovelo, Ecuador. The demonstration plant was built and used to train miners on methods to reduce and/or eliminate the use of mercury while increasing gold recovery. Miners from Peru, Colombia and Ecuador have learned techniques that include gravity concentration, flotation, and cyanidation.

### Outcomes

- Hg levels in the region were reduced b approximately 50%;
- Higher and more efficient gold extraction rates via gravity-flotation-cyanidation plants;
- Change in overall perception of artisanal miners that cleaner extraction processes can lead to more profitability and health benefits;
- A pre-feasibility study of a small processing plant operating with gravity concentration, flotation, and cyanidation revealed that with gold grade equal to or above 10 g/t, even by achieving a gold recovery rate of only 50% (US $1,300/oz of Au), a 10 t/day plant is still profitable.

### Favorable Conditions on the Ground

- Active participation of miners in the decision-making process;
- Increased presence of and support from the local government;
- Movement towards formalization of the small-scale mining sector.

(Above) The demonstration plant in Portovelo, Ecuador for education and training of artisanal miners. (Right) A grinding mill with rotating cement wheels common in Portovelo. Photos: Marcello Veiga.

### Reasons for Success

- *Close collaboration* among local technical and engineering experts, outside investors, government officials, and owners of processing centers provided all the elements for development and adoption of Hg-free mining techniques. In particular, strong private sector investment provided needed financiing for these developments;
- *International training and cooperation efforts:* the government invested in organizing trainings and formalizing miners as a way to improve working conditions and create a favorable investment environment;
- *Technical support* from local experts, engineers, and international mining experts from the Dept. of Mining Engineering at the University of British Columbia (Canada) help to turn the adoption of Hg-free techniques from rhetoric to reality.

### For More Information

Veiga et al. (2014). Processing centres in artisanal gold mining. Journal of Cleaner Production DOI:10.1016/j/jclepro.2013.08.015

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