FACT SHEET

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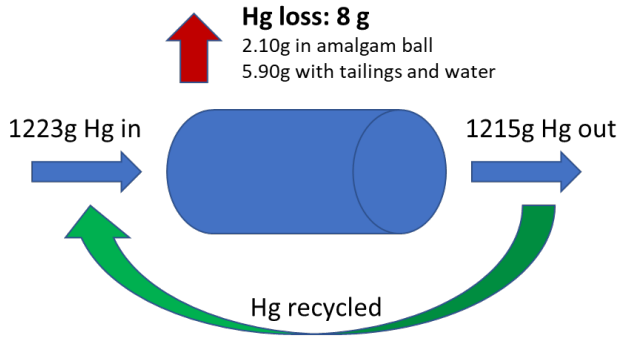
Quantifying Hg loss from amalgamation and potential Hg reduction with Hg-free processing

Field research conducted by the GOLD-ISMIA project team at Buwun Mas and Kedaro villages at the Sekotong field location investigated the mass balance of Hg during amalgamation in a rod mill.

Mass-balance for Hg use during amalgamation

The project team recorded the mass of Hg added to a gelondong during amalgamation, and the amount recovered for reuse. Total Hg loss from the system was 8 gram. This was 0.65% of the mass of Hg added: 99.35% of the Hg added was recovered for reuse. 2.10 g of this Hg was accounted for in the amalgam ball: this was the mass lost during burning of the amalgam to generate the metal bullion.

> 5.90 g Hg was dispersed in rock and water during milling, and lost to the environment. This is 0.65% of added Hg lost to the environment.



Calculation of total Hg losses across four project locations

Four GOLD-ISMIA project locations (Anggai, Tatelu, Pelangan and Buwun Mas) have been surveyed by the project team to record the number of tong operating, and the capacity of each tong.

The project assumes that the ore is ground in rod-mills prior to cyanidation in tong. The project assumes that all ore in these locations is sequentially processed by amalgamation and then cyanidation.

Using the number of tong, their capacity and knowledge of the number of batches processed per month, the total tonnes of ore processed in each location can be calculated. All of this ore will have been milled in gelondongs prior to cyanidation.

The project assumes that an average mass of 25 kg of Hg is used for amalgamation per tonne of ore milled. With this figure the total mass of Hg used can be calculation: for the four locations this is 852.6 tonnes. However, based on our mass balance calculations, 99.35% of this Hg is recovered and re-used.

5.54 tonnes Hg is lost to the environment.

Location	Anggai	Tatelu	Pelangan	Buwun Mas	Total
Number of tong	20	30	73	24	
Average tong capacity (tonnes)	5	5	5	6	
Number batch processed per month	2	5	4	3	
Total tonnes ore processed per month	200	750	1460	432	
Total tonnes ore processed per year	2400	9000	17520	5184	34104
Total Hg used (tonnes)	60	225	438	129.6	852.6
Hg lost per year (tonnes)	**0.39**	**1.46**	**2.85**	**0.84**	**5.54**

Correlation of Hg loss with mass of gold produced

The mass of gold produced by tong across the same four locations was also surveyed by the project team.

Total gold produced was 0.87 tonnes, from 34,104 tonnes of ore processed, for an average gold grade of 25.4 g/tonne.

Location	Anggai	Tatelu	Pelangan	Buwun Mas	Total
Number of tong	20	30	73	24	
Gold (98-99%) produced per tong (g)	5	5	5	6	
Number batch processed per month	2	5	4	3	
Gold produced per month (g)	6000	22500	35040	8640	
Gold produced per year (g)	72000	270000	420480	103680	866160
Gold produced per year (tonnes)	**0.07**	**0.27**	**0.42**	**0.10**	**0.87**

The ratio of Hg released (5.54 tonnes) to gold produced (0.87 tonnes) is 6.875 to 1. This means for ever gram of gold produced, nearly 7 grams of gold is released to the environment.

The data interpretation reported here agrees with internationally published case studies. Veiga et al. (2009)[1] after field observations in Indonesia, stated '*when Hg is used inside ball mills to amalgamate the whole ore, the amount of Hg lost is at least 10 times the amount of gold produced*'.

[1] Mill Leaching: a viable substitute for mercury amalgamation in the artisanal gold mining sector? Journal of Cleaner Production. 17: 1373-1381.

Realising the GOLD-ISMIA target for Hg reduction

Technical data proves that amalgamation is an inefficient process for gold recovery from Indonesia primary gold ores. Across Indonesia, cyanidation has been proven to yield substantially greater gold from the same ore.

Technical interventions to increase the technical capability of both micro-scale gelondong operators and small-scale tong operators must also be considered. It is Hg use during grinding that must be stopped.

A key assumption of this fact sheet is that Hg is currently being added to all ore milled at the surveyed locations.

Removal of Hg from gelondongs at the surveyed locations will lead to a Hg reduction of 5.5 tonnes per year.

Written by Prof. Chris Anderson (Chief Technical Advisor of GOLD-ISMIA Project) with support from Baiq Dewi Krisnayanti (National Project Manager of GOLD-ISMIA Project). Special appreciation for the Field Facilitators for staying in their respective duty stations, being away from family at this difficult time.
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