planetGOLD
Making a world of difference in small-scale gold mining.
A GEF Initiative

Guidance for Calculation of planetGOLD Cross-Programme Output Indicators

May 2023

Supported by: gef

Led by: UN environment programme

Table of Contents

Abbreviations/Acronyms

Abbreviation/Acronym	Definition
ASGM	Artisanal and Small-scale Gold Mining
AGC	Artisanal Gold Council
Au	Gold
GEF	Global Environment Facility
Hg	Mercury
K	Karat, measure of gold purity
MFPS	Mercury Free Processing System
MIA	Mercury Initial Assessment
MTR	Mid Term Review
NAP	Minamata Convention National Action Plan for ASGM
NGO	Nongovernmental Organization
NRDC	Natural Resources Defense Council
OECD/DAC	Organization for Economic Co-operation and Development/ Development Assistance Committee
OHS	Occupational Health and Safety
PC	Projekt-Consult
PSC	Project Steering Committee
PIR	Project Implementation Report
ProDoc	Project Document
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization

1 Introduction

The planetGOLD programme works in partnership with governments, the private sector, and ASGM communities to significantly improve the production practices and work environment of artisanal and small-scale miners. The programme aims to demonstrate a pathway to cleaner and more efficient small-scale gold mining practices that benefit everyone, from mine to market, with a focus on reducing, and where feasible eliminating, the use of mercury in the sector.

The programme has four key pillars by which it aims to achieve its mercury reduction target (see Figure 1):

- Helping to formalize the sector, which is a fundamental prerequisite for miners to obtain assistance and access to formal finance,
- Working to enhance the availability of formal finance, which can be used for purchase and operation of mercury-free equipment,
- Providing technology transfer and training around mercury-free processing methods, as well as other elements of responsible production, which can help miners meet requirements of responsible buyers, and
- Facilitating access to formal supply chains, which may provide better and more reliable income.

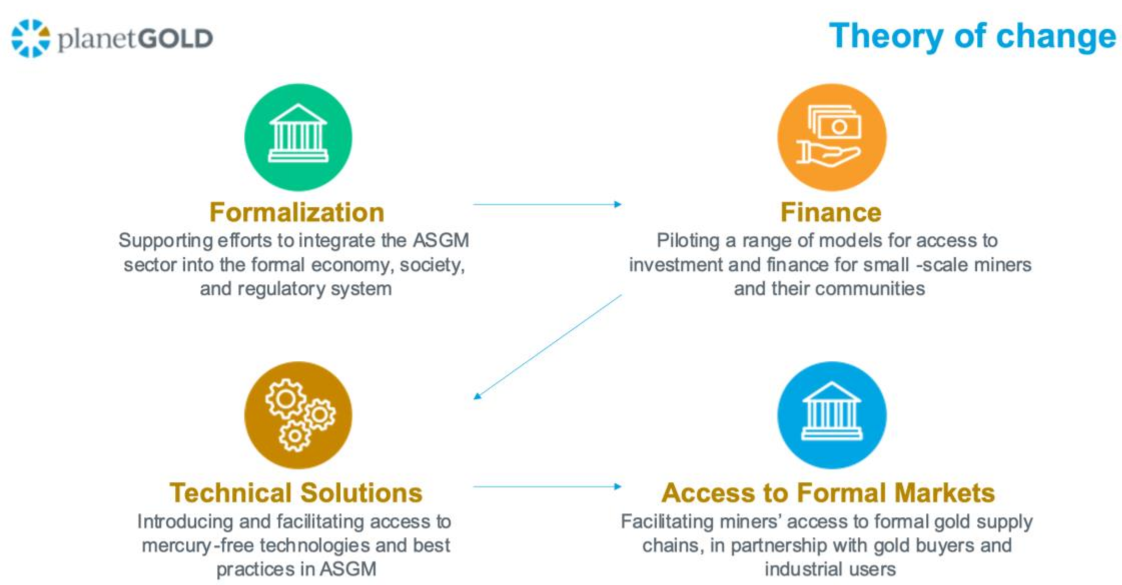


Figure 1: planetGOLD Programme Theory of Change

Each country project within the planetGOLD programme includes outcomes, outputs and activities corresponding to each of these four programme components. For each of the elements, there can be direct impacts of the project interventions, as well as indirect impacts from "social spillover" as new knowledge is transmitted through informal social channels. Further, the impacts of the projects can result not only from interventions during project life, but also from replication of approaches pioneered by the projects, across wider geographic areas and into the future.

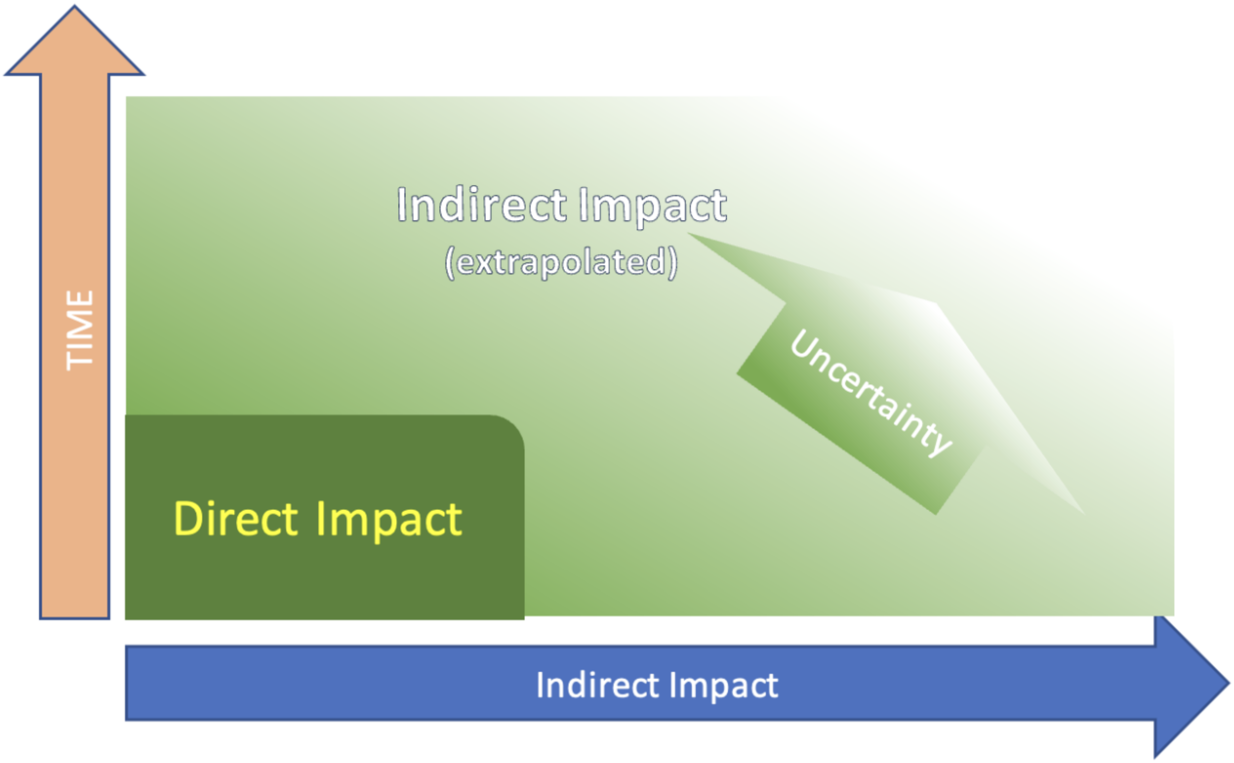


Figure 2: Extrapolation over time and for indirect impact

The global component of the planetGOLD programme tracks key output indicators for these four components across the programme, based on reporting from the planetGOLD country projects. Because of the variety of country-specific approaches and activities under four programme components, there is no "one-size-fits-all" indicator for each component; however, these cross-programmatic output indicators fall into the following general categories:

1. *Tonnes of mercury reduced/avoided*
2. *Number of miners supported in their formalization processes*
3. *Amount of money made available to ASGM[1] through financial mechanisms*
4. *Amount of responsible[2] ASGM gold produced*

The purpose of this guidance document is to elaborate on the definitions of these cross-programmatic indicators and to provide guidance on their estimation and presentation, both within the timeframe of the project and after project life. The guidance aims to provide common understanding and consistency in general approach among planetGOLD countries, that can be adjusted to the circumstances of each country situation.

[1] For the improvement of ASGM operations
[2] In this context, "responsible" means that operations conform with the planetGOLD Criteria for Environmentally and Socially Responsible Operations

2 Definitions and Recommended Methods for Calculation

2.1 Output Indicator no. 1: Mercury reduced/avoided

2.1.1 Definitions

Indicator category no.1 is: "Tonnes of mercury reduced/avoided".

Due to the variety of projects and their specific project environments, there is a need to refine the concepts of "reduced" and "avoided" and introduce further definitions that align with the range of project interventions. This indicator can be further elaborated to include the terms "reduced", "eliminated", "prevented", and "avoided". The table below provides suggested definitions and explanations for these categories. Specifics on the calculations for these categories are provided in the following sections.

Term	Definition
Reduced	The change in the amount in mercury lost to the environment as a result of the introduction of processes that reduce mercury lost per unit of gold production (includes introduction of less mercury-intensive amalgamation methods and/or mercury capture during burning/smelting of sponge gold)
Eliminated	The change in the amount of mercury lost to the environment as a result of the introduction of mercury-free gold production processes
Prevented	The amount of mercury loss to the environment that is assumed to be prevented by the introduction or ongoing support of mercury-free methods. This can be used where there is no official mercury use baseline for the intervention site because: - mercury use is illegal; in this case, the project introduces new mercury-free processing capacity but cannot directly prove if new capacity is displacing illegal mercury use or is supporting new (additional) mercury-free gold production capacity, OR - the intervention site was already mercury-free when the project began but project intervened to avoid backsliding.
Avoided	The amount of mercury loss that will no longer occur, due to maintaining project intervention gains over time.

The "mercury abatement" of the project at end of project life is the sum of mercury reduced, eliminated, prevented and/or avoided by project activities.

2.1.2 Calculating mercury use before and after interventions

To estimate mercury reduced, avoided, eliminated, or prevented, it is necessary to estimate mercury use before and after planetGOLD project interventions. Note in this context, the term "mercury used" refers to the amount of mercury that is expended during processes that use mercury; that is:

mercury used = [amount applied during processing] – [amount recovered for re-use after application + amount recovered from mercury capture systems during amalgam burning/gold refining e.g., at gold shops]

In other words, "mercury used" is equal to the amount lost to the environment (including to tailings), which must be replaced by a mining/processing operation as long as it continues mercury-based processing.

There are several ways to characterize mercury use. In some cases, projects may have data on mercury purchases from legal mining operation records, before and after intervention; further they may have data on the amount of mercury recovered by mercury capture systems at gold shops before and after intervention, reflecting a reduction of mercury lost to the environment. However, given nature of the artisanal and small-scale mining sector, the typical informal environment, the usual secretiveness about gold production in general, and the sometimes-illegal status of mercury use, it should be recognized direct measurements of the amount of mercury used are generally not feasible in practice[3]. This amount is thus estimated based on assumptions, (often rather rough) estimates and extrapolations[4].

One approach often used to estimate mercury use is to (1) estimate the amount of gold produced, then (2) multiply that value by a "mercury to gold ratio" to yield (3) the total amount of mercury used.

- To estimate the amount of gold produced, data can be gathered from the sales records of miners directly targeted by the project. However, miners are often hesitant to share these figures, or may not keep accurate written records. Alternatively, one may get overall production figures in a given area from local gold buyers, if they are known to buy most of the gold produced in that area and are willing to cooperate. However, more commonly, indirect estimation procedures are used to estimate gold production.
- The mercury to gold ratio (Hg:Au ratio) is the amount of mercury used (using definition above) per unit of gold produced. The ratio (U_{Hg}) is calculated using the following formula:

[3] If resources allow, planetGOLD country projects are encouraged to conduct selected on-site direct measurements of mercury use and emissions.

[4] The National Action Plans (NAPs) include national baselines on mercury use, which should be considered by planetGOLD projects in their estimates and extrapolations. In this regard and based on their own calculations and measurements, country projects may be able to recommend refinements to NAP data during its implementation reviews.

$$U_{Hg} = \frac{Hg_{lost}}{Au_{produced}}$$

This estimation approach can be used to estimate mercury use in a given operation (such as a planetGOLD direct intervention site) and/or extrapolated across operations of similar type (such as operations in areas where planetGOLD is intervening through awareness raising and training activities).

The document entitled "*Estimating mercury use and documenting practices in artisanal and small-scale gold mining (ASGM): Methods and Tools*" (O'Neill and Telmer, 2017) was developed to provide guidance on estimating the baseline amount of mercury use in ASGM. The document has been extensively employed in the development of baseline mercury inventories, as part of National Action Plans (NAPs) under the Minamata Convention. The document is available in English, French and Spanish:

https://www.unep.org/globalmercurypartnership/resources/tool/estimating-mercury-use-and-documenting-practices-artisanal-and-small-scale-gold

That reference contains detailed guidance on estimating gold production as well as estimating the Hg:Au ratio, where direct data are not available from miner or buyer records. Annexes I and II summarize some of these methods, but readers are encouraged to read to the reference for more details and examples.

2.1.3 Estimating Mercury Reduced

"Mercury reduced" refers to the change in the amount in mercury lost to the environment as a result of the introduction of processes that reduce mercury lost per unit of gold production This can occur when methods are introduced which are not mercury-free but reduce the discharge of mercury into the environment (e.g., by adopting concentration amalgamation instead of whole ore amalgamation, and/or recovering the Hg using gold retorts):

$$Hg_{reduced} = (Au_0 * U_{Hg0}) – (Au_1 * U_{Hg1})$$

where:

Variable	Acronym	Unit	Definition
Initial Hg:Au ratio	U_{Hg0}	ratio	Hg:Au ratio before the project's intervention
Final Hg:Au ratio	U_{Hg1}	ratio	Hg:Au ratio after the project's intervention (when intervention is not mercury-free)
Initial Annual Gold Production	Au_0	Kilograms per year	Amount of gold produced per year prior to intervention
Final Annual Gold Production	Au_1	Kilograms per year	Amount of gold produced per year after intervention

In this case, data needs to be collected on how much mercury is used post-intervention compared to the original mercury use, as well as on changes in gold production post-intervention.

2.1.4 Estimating Mercury Eliminated

"Mercury eliminated" refers to the change in the amount of mercury lost to the environment as result of the introduction of mercury-free processes. In this case, the amount of "mercury eliminated" is equal to the amount of mercury lost to the environment prior to the mercury-free intervention:

$$Hg_{eliminated} = U_{Hg0} * Au_0$$

Note that this calculation can be used in the case where mercury-free processing is introduced at a mining/processing operation, or where mining operations shift to selling their ore to a mercury-free processing center as a result of project activities.

2.1.5 Estimating Mercury Prevented

"Mercury prevented" refers to the mercury loss to the environment that is assumed to be prevented by the ongoing support of mercury-free methods. This definition can be used where there is no official mercury use baseline for the intervention site. This could be the case because mercury use is illegal in the country, although mercury is known to be used in the intervention area. In this case, if the project introduces new mercury-free processing capacity, it is often not known whether the capacity is displacing illegal mercury use or is supporting mercury-free processing of new gold production capacity.

However, in either case, mercury use is prevented. "Mercury prevented" may also be used when the intervention site was already mercury-free when the project began but the project intervened to avoid backsliding.

The "mercury prevented" is the estimated amount of mercury that would have been needed to produce the same amount of gold which is now produced at the mercury-free intervention site. It can be calculated by multiplying the amount of gold produced after the intervention, times a typical Hg:Au ratio assumed to prevail prior to intervention:

$$Hg_{prevented} = U_{Hg0} * Au_1$$

In this case, the Hg:Au ratio can be based on known/suspected locally prevailing practices, data from the literature on similar practices, or historic data on mercury-based methods at the site or in the region.

2.1.6 Mercury Avoided over Time

“Mercury avoided” is the amount of mercury loss that will no longer occur in the future, because technical intervention gains are maintained over time. It is assumed that the impact of technical interventions from a project will be maintained far beyond the end of its immediate lifespan, because the physical outputs and investments are assumed to remain in place and continue to produce “cleaner” gold.

To calculate mercury avoided, the mercury reduced, eliminated and/or prevented at intervention sites is extrapolated over a given length of time after the intervention is initially put into place:

$$Hg_{avoided} = [\, Hg_{\mathrm{reduced}} + Hg_{\mathrm{eliminated}} + Hg_{\mathrm{prevented}} \,] * T_{\mathrm{extrapolation}}$$

Where:

$T_{\mathrm{extrapolation}}$ = length of time that mercury abatement from technical interventions [measured at end of project life] is expected to be maintained (in years)

The standard assumption[5] is that the project output remains (at least) constant for the remaining estimated active life of the mining operations which have adopted mercury-free technology, using the final project year as a benchmark.

When considering the length of time to use for this calculation, site-specific factors such as the estimated ore reserves, length of validity of the site permits, the estimated lifespan of the equipment/operation, socio-economic factors (e.g., whether the miners are long-term residents in the area or mobile migrants), etc. should be considered. The calculation should be transparent and justified. A period of time between 5 to 10 years would be a typical assumption; any time exceeding 10 years would be considered exceptional and would require a well-documented justification.

Given the need for the site-specific information to determine a reasonable time frame for extrapolation, the estimation of mercury avoided in the future is recommended to be applied to direct technical project interventions only, unless detailed information is available on mining/processing operations who realize mercury abatement through educational activities of the project (see section 2.1.7 for further explanation).

An example of how to extrapolate outputs over time is shown in Annex III.

[5] Sustainability is a challenge for every project of this kind. Based on experience, some stakeholders may find this assumption over-optimistic, however, the number of miners abandoning the project after the end of its lifespan may be equalized by an increased production of others and/or newcomers.

2.1.7 Calculating mercury abatement from technical versus educational interventions

Country projects engage in different kinds of technology transfer interventions. For selected groups, projects provide lower mercury/ mercury-free equipment such as mercury-free processing systems, on a pilot basis. The resulting mercury abatement is a direct impact of the technical intervention and can be calculated using the formulae in the previous sections.

Projects also engage in educational activities, such as technology demonstrations, training, and awareness-raising campaigns, that are meant to foster the transition to mercury-free technology through the provision of information and promotion of behavioral change. The mercury abatement attributed to these activities can be considered direct educational impacts of the project. Finally, the project can have indirect impacts through the uptake of low-mercury and mercury-free technologies that occurs through informal miner-to-miner learning, imitation and replication by other actors across geographies without any direct project engagement.

To estimate these impacts, three types of project impact areas need to be defined (as part of the baseline study, during the project implementation, or, at the latest, for the final reporting):

- Technical Intervention Site: Clearly defined target operations in the project intervention area who benefit from provision of new technology.
- Educational Intervention Area: Operations beyond the technical intervention site that do not receive provision of new equipment, but who directly participate in project-sponsored trainings, awareness raising events, etc.
- Surrounding Areas: Operations in the wider vicinity, that were not actively targeted by the project, but which can be reasonably assumed to be indirectly influenced by the project’s general interventions (e.g., broad media campaigns) and through miner-to-miner learning/imitation/replication, resulting in adoption of lower-mercury or mercury-free methods.

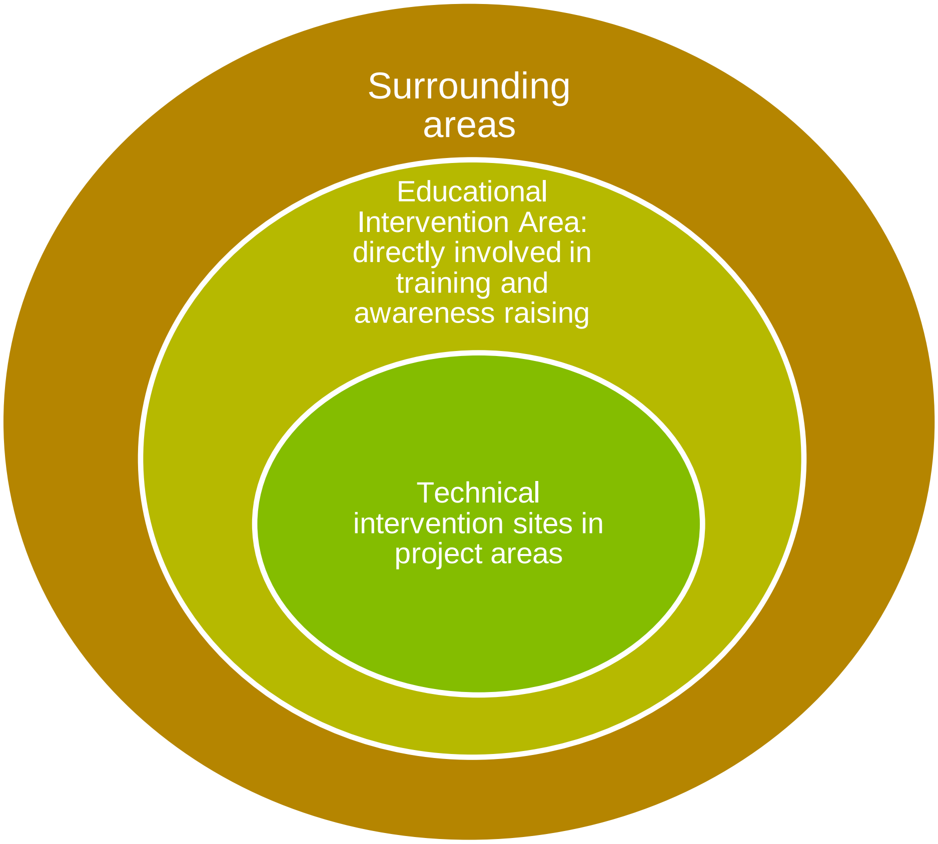


Figure 3: Types of impact areas

For areas of impact beyond the technical intervention sites, relevant data needs to be gathered by the project (towards the end of the project / in preparation of the final evaluation or impact assessment) to estimate how many (if any) mining/processing operations have adopted lower mercury or mercury-free gold production methods. In some cases, projects may be able to track uptake of cleaner technologies in these broader impact areas, for example, if data are available on the number of new mercury-free operations (e.g., new leaching plants) that have been set up in the wider project area after the intervention.

Further, if the type/size of operations, as well as the estimated mercury reduction associated with the adoption of cleaner methods is known (e.g., elimination of mercury through use of leaching methods), this information can be used to calculate mercury reduced, eliminated or prevented, using the formulae above.

Tracer Survey: Absent such specific data, the mercury abatement impacts from project training/awareness raising activities in the Educational Intervention Area can be estimated. Because it cannot be automatically assumed that 100% of the miners/mining operations will introduce cleaner methods after the training/awareness raising, an estimate of the percentage adopting new methods is needed through tracing.

While ideally projects could visit/follow up with as many sites as possible, a sample of at least 5 to 10 % of the trainees and/or people attending awareness raising activities should be visited or otherwise contacted[6] (at an established interval after the training, or during the project final evaluation) to establish the percentage who have adopted cleaner methods (and if not, why not.[7]).

The percentage uptake, multiplied with the entire number of miner trainees/ represented mining operations who participated in awareness raising activities, gives an estimate of the number of miners/ mining operations with educational impacts beyond the technical intervention sites:

$$F_{educational} = \text{percentage uptake} * \text{number of miners/operations engaged in trainings/awareness raising}$$ [8]

Mercury abatement from educational activities, $Hg_{educational}$, can then be estimated as:

$$Hg_{educational} = [\, Hg_{reduced} + Hg_{eliminated} + Hg_{prevented}] * F_{educational}$$

The application of this factor should be considered an upper bound estimate of educational impacts, as it assumes that those taking up cleaner methods have similar size operations, have adopted similar methods, and have achieved similar results to those achieved at the technical intervention sites. To the extent data are available regarding the size of operations, the specifics of the methods adopted etc., in these wider areas, those data can be used to temper the multiplier.

---

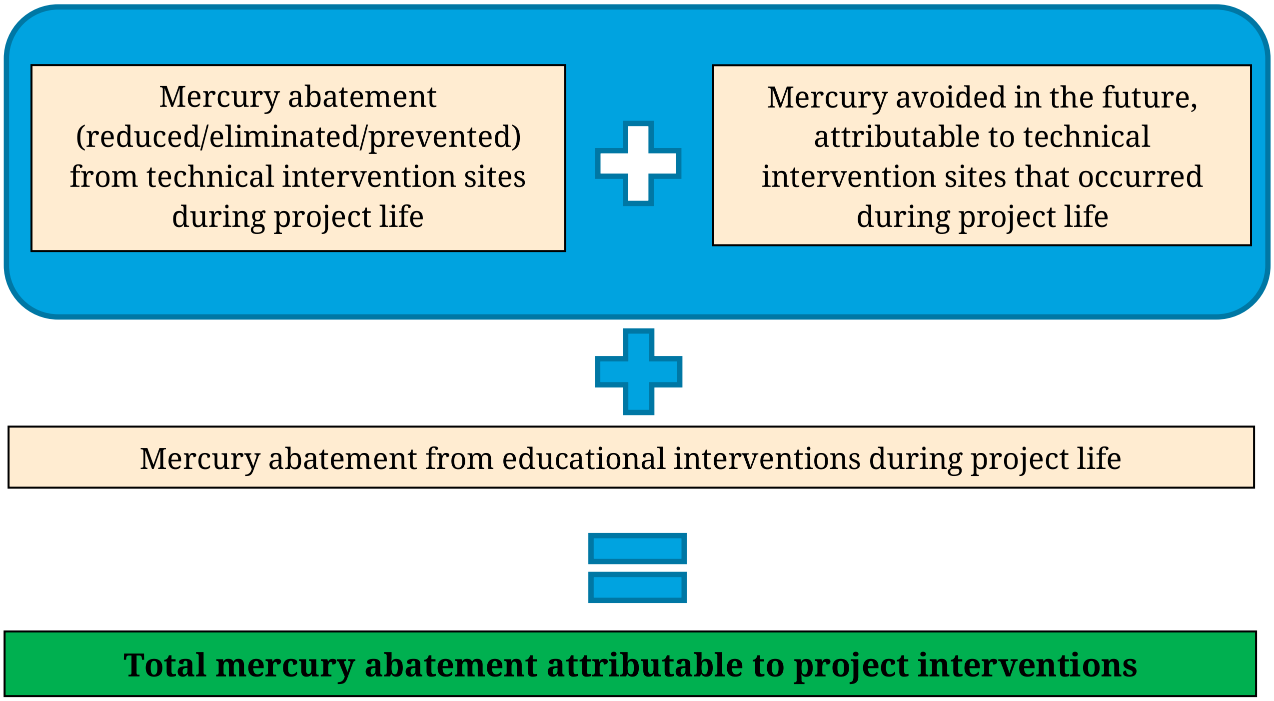
6 The exact design of such a Tracer Survey cannot be standardized since it depends on the project-specific circumstances. In most cases, areas targeted for educational activities are those nearby/surrounding the technical intervention sites and are relatively easily (and affordably) available for field visits. Usually trainees/ targeted operations from such an area can be contacted and even visited as needed. In such cases, an appropriate combination of remote contacts (per phone, email, WhatsApp, etc) and physically visiting the sites to verify data should be applied. In cases where such field visits are not feasible (too expensive, etc.), remote methods can be considered. Country projects are requested to design their own appropriate study approach. In any case the chosen approach needs to be justified.

7 This is not needed for this indicator but for the lessons-learning.

8 Projects should ensure that the unit of analysis (miner or mining operation) matches the level at which Hg abatement is calculated. That is, if abatement is estimated at the miner level, then $F_{educaiotnal}$ should consider the number of miners engaged in training. If Hg abatement is estimated at the group or operation level, then $F_{educational}$ should consider the number of groups or operations engaged in trainings.

2.1.8 Final Mercury Abatement Calculation at End of Project

The final estimation of mercury abatement attributable to project activities can be calculated as the sum of: the impacts from direct interventions during project life, the mercury avoided in the future due to the direct interventions undertaken during project life, and the abatement attributable to the indirect activities during project life:



2.2 Indicator no. 2: Formalization

Indicator no. 2 is: "Number of miners supported in their formalization process (including gender-disaggregated data)". Support to formalization is one of the key objectives for planetGOLD country projects and is foundational to achieving the outcomes in the other project pillars. Projects may intervene with several different kinds of stakeholders to support formalization (e.g., through training of government officials to educate them on ASGM regulations), and those types will vary by country; however, all countries commonly include efforts to support miners and mining operations, so this beneficiary group is the focus of this cross-programmatic indicator.

To calculate this indicator and estimate the number of beneficiaries supported in formalization, we use the following definitions:

Miner: Individuals working at mining sites or workers directly employed in the gold production system (both extraction and processing), including extraction workers, processing workers, and mining/processing foremen.

Mining operation: Business operations that can include extraction and/or processing. Mining operations can be organized in different ways, including but not limited to[9]:

1. Independent operations of individual miners who extract and process ore and sell gold;
2. Small/medium-scale businesses, where miners work for an owner or financier who pays wages and/or shares profits from the ore;
3. Mining cooperatives.

2.2.1 Number of beneficiaries from direct assistance on formalization

Projects may provide direct support to miners, through mentoring, coaching and legal support to mining operations (for example to form cooperatives[10], obtain permits, or take other steps to become fully formalized). In this case, country projects should report both number of mining operations receiving this kind of support, as well as the number of miners benefited. The miner data reported for this indicator need to be *gender-disaggregated*. When reporting, the countries should specify the type of direct support provided. The data should be available from the project monitoring reports, for the respective activities. Note, it is important to avoid double counting. For example, if legal trainings are provided to the same miners/cooperatives over time, the miners/operations should be only counted once and not each time there is a training.

Optional indicator: Number of miners/mining operations who have successfully legalized their operations: As an optional additional indicator, country projects may wish to report the number of miners/mining operations within the project area who have successfully met all legal requirements including mineral rights/mining licenses/ environmental permits/closure plans, etc. as a direct result of the project activities.

[9] O'Neill and Telmer, 2017. "*Estimating mercury use and documenting practices in artisanal and small-scale gold mining (ASGM): Methods and Tools*", pg.24.

[10] Some countries, such as Burkina Faso, have supported the association of individual miners to form cooperatives and thus facilitate the formalization processes (in their logframe they have a specific indicator of n° of cooperatives created within this component), among which they are also supporting the creation of a women's cooperative.

2.2.2 Number of beneficiaries from educational activities on formalization

In addition to direct support, projects may also provide awareness raising initiatives, trainings, etc. to groups of miners and/or cooperatives within the project area, that indirectly support their formalization efforts. Countries should report on the total number of mining operations and miners supported through these kinds of group training interventions, and the type of support provided should be indicated. Again, the data on miners must be gender-disaggregated. The data can be gathered from the reports, for the respective activities.

Further, some country projects have engaged in the creation of systems or tools meant to benefit miners who wish to become formalized, for example the creation of online tools to record gold sales. If data are available, miners/mining groups who then use these tools or systems could also be considered beneficiaries.

2.3 Indicator no. 3: Responsible ASGM gold production

2.3.1 Responsible Gold Produced/Sold

Indicator no. 3 reports on the amount of responsible gold produced and/or sold to the formal market. The issue of establishing the amount of gold produced by operations assisted by planetGOLD country projects has been discussed above in section 2.1.2.

However, not all gold produced under a planetGOLD project, even if produced mercury-free, is necessarily "responsible" gold. Gold produced under the programme is considered "responsible gold' if it is produced in conformance with the *'planetGOLD Criteria for Environmentally and Socially Responsible Operations'*. These can be found in the document:

https://www.planetgold.org/sites/default/files/planetGOLD_Criteria_for_Environmentally_and_Socially_Responsible_Operations_Feb21.pdf

2.3.1.1 Amount of responsible ASGM gold produced

Responsible gold production, in kilograms per year, from planetGOLD participating operations can be counted and reported for this indicator, if the operations conform with planetGOLD criteria. To demonstrate conformance with the criteria, the operations should have submitted planetGOLD reports, which describe the conformance status, supported by evidence, for all criteria. Guidance on the planetGOLD criteria as well as report template forms are found here: https://www.planetgold.org/criteria.

2.3.1.2 Amount of responsible ASGM gold sold to formal markets

In cases where a formal supply chain mechanism has been developed by the project, and gold sales from planetGOLD participating operations can be traced from mine to a formal market/buyer, country projects should report the kilograms of gold (cumulatively) sold via this mechanism.

2.3.1.3 Amount of responsible ASGM gold produced/sold after project end

As with the mercury abatement calculation discussed above, gold produced/sold from responsible operations supported by the project will continue to be produced/sold after project end. When sufficient information exists to estimate a length of time that an operation will continue to produce/sell responsible gold, this factor can be applied to the indicator calculation. This factor should be consistent with the factor chosen to calculate mercury avoidance; further, there should be a reasonable basis to assume that the operations will also remain in conformance with the planetGOLD criteria.

2.3.2 Educational Impacts

If there are reliable data to show that education, training or demonstrations of supply chain mechanisms, or other efforts to establish traceable gold to formal markets, led to adoption and/or additional establishment of new supply chains beyond the mechanisms established by the project, projects can report the amount of responsible gold produced and/or sold to formal markets as educational impacts of the project.

2.4 Indicator no. 4: Amount of money made available

Indicator no. 4 is defined as: '*the amount of money made available to ASGM through financial mechanisms (disaggregated by gender and indigenous people)*'

All planetGOLD projects have a component on supporting increased access to formal finance for miners. This is usually done in cooperation with commercial banks, micro-lending schemes and/or formal investors who can provide financial services, and by supporting miners with relevant capacity building in terms of business skills, support to develop bankable documents, etc. This indicator is meant to track the number of new financial product types (e.g., microfinance loan product aimed at ASGM miners) and/or mechanisms (e.g., revolving fund, new credit window for miners, etc.) developed by the planetGOLD projects to support responsible and formal ASGM, as well as the amount of money that flows to miners because of activities to improve their access to formal finance.

2.4.1 Estimating amount of money made available through development of new financial mechanisms

Projects should report on the following aspects of the financial mechanisms developed to support access to finance for responsible ASGM under their projects, to the extent the data are available:

- Number of new financial products/mechanisms developed/supported by the project to provide access to finance for responsible ASGM over the life of the project.
- For each of those products/mechanisms, the amount of money available for miners/ ASGM operations through those mechanisms (cumulative, in USD equivalent).
- The amount of money accessed by miners/ASGM operations via those mechanisms (cumulative, in USD equivalent).
- The number of miners/ASGM operations receiving finance from mechanisms developed/ supported by the project over the lifetime of the project.
- Average amount of finance received per miner/ASGM operation.
- If known, use of proceeds should be noted.

While individual financial transactions are likely to be confidential to some degree, cooperating partner organizations (banks, micro-lending institutions, etc.) should be encouraged to provide data on the finance that has been provided to miners as a (direct or indirect) result of the project's interventions, including the elements listed above.

If possible and feasible[11], the data should be gender-disaggregated as well as whether the beneficiaries are indigenous people.[12]

2.4.2 Educational impacts

Through education of miners on basic financial skills, raising awareness of existing programs for which they may qualify and training on how to apply for loans, miners may be able to access finance from existing formal financial sources, such as microcredits, special programs for SMEs, programs for women entrepreneurs, etc. Data collected from miners on their success accessing these existing mechanisms after training can be a measure of the educational impacts of the project on access to finance. In this case the indicators would be:

- The amount of money accessed by miners/ASGM operations after training from existing financial mechanisms (cumulative, in local currency or in USD equivalent)
- The number of miners/ASGM operations receiving finance (disaggregated by gender and noting if recipients were indigenous people)
- Average amount of finance per miner/ASGM operation (in USD equivalent).

[11] In cases where the data is provided by banks or other partners, disaggregated data may not always be available. In such cases, the project should encourage partner institutions to gather respective disaggregated data.

[12] Some countries such as Colombia, consider also other minorities (i.e. afro-Colombian communities) in the disaggregation.

2.5 Additional guidance

Annex 4 shows hypothetical example calculations for each of the cross-programmatic indicators. Further Annex 5 provides a comprehensive list of the indicators.

3 Replication beyond the lifespan of the intervention

The planetGOLD projects are intended to demonstrate how formalization, access to finance and formal markets, and technology transfer work together to support adoption of better, mercury-free practices, and to provide a model that can be replicated to other areas and other beneficiaries.

While this replication may occur during project life[13], usually it takes time to develop and fully implement approaches over the lifespan, and projects reach their "best results" only towards the end of the implementation period, after which the results may be replicated.

Replication may occur via private efforts of miners and other stakeholders, and/or through additional government-funded, bilateral, or multi-lateral technical assistant projects. The activities undertaken by planetGOLD under its four project components are intended to align with strategies required to be included in the Minamata Convention National Action Plans for ASGM (NAPs), which Parties with "more than insignificant" ASGM must develop and implement. Per Annex C of the Convention, the NAPs must include strategies for formalizing or regulating the sector (which in practice, often includes increasing access to finance), introducing strategies to eliminate worst practices and reduce mercury use generally (often including technology transfer and training) and may optionally include market approaches such as supply chain mechanisms. Ideally, planetGOLD country teams should work hand in hand with the officials responsible for implementation of the NAPs.

The results, achievements and examples of project interventions should therefore feed into and strengthen the ongoing implementation of the NAP strategies, providing a basis upon which further sustainable mercury abatement can be realized. For example, this could include:

- Further technology transfer of less mercury intensive/ mercury-free technologies tested under planetGOLD.
- Training of miners (beyond the immediate planetGOLD target group) using planetGOLD-developed training curriculum, embedded at vocational schools and other key educational institutions.
- Awareness campaigns of mercury-free technology (beyond the immediate target group) modeled on planetGOLD campaign strategies.
- New and additional sources of finance, modeled after mechanisms and partnerships created under planetGOLD.
- Further capacity-building efforts for miners, etc. built on efforts undertaken in planetGOLD to enhance formalization.

[13] If the project has evidence that replication has occurred during project life, eg through adoption of planetGOLD approaches by government actors, other stakeholders, co-financing partners, etc., that evidence should be reported during project life.

3.1 Estimating level of effort required to meet mercury abatement targets

It is difficult to predict in advance the extent to which planetGOLD results will be replicated after the end of the project, leading to mercury abatement in the future.

However, it is possible to look at the mercury abatement results at end of project, consider the measures that led to those results, and estimate the further level of effort required under the NAP strategies or other country-level initiatives to support achieving an identified mercury abatement target. The additional levels of effort can be then matched to a NAP strategy through which this further mercury abatement can be realized.

3.1.1 Mercury Abatement Replication

The level of further direct interventions in technology transfer and miner training required to achieve mercury abatement can be estimated based on planetGOLD results by end of project. The table below illustrates, with a simplified hypothetical example, how this link can be made:

Hg abate-ment target	Total mercury abatement by end of project	Reductions from project intervention types	Additional mercury impact to be replicated to achieve Hg goal (tonnes)	Multiplier	Additional activity needed to achieve additional impact	Corresponding NAP strategy or known initiative
15 tonnes	5 tonnes	1 tonne reduced from mercury -free alternative technology at one demonstration site	2 tonnes eliminated	2	At least two additional sites of comparable size are assisted to become mercury free	Strengthen technical assistance and demonstration programmes in ASGM operations, across all designated ASGM mining districts, to ensure miners become aware of and adopt techniques to reduce mercury use

						and promote the use of mercury-free techniques and technology
		4 tonnes eliminated through training to 100 miners on how to reduce mercury use; of these 50% adopted measures	8 tonnes eliminated	2	At least 200 miners with similar production trained, with 50% uptake rate	Enhancing capacity of ASGM actors in safe and efficient mining through vocational training

3.1.2 Indicators for creating the enabling environment

The replication of adoption of mercury-free technology, and thus mercury abatement, will also depend on future work to continuously improve and expand the enabling environment, including formalization, finance and responsible sourcing measures initiated by planetGOLD.

As a first approximation, an assumption can be made that the outputs for each of these elements supported the mercury abatement achieved under planetGOLD by end of project. These activities would thus need to be replicated to support an equal magnitude of mercury abatement in the future. Therefore, the same multiplier needed to achieve the mercury abatement goal should be used to estimate the level of replication needed for additional enabling activities indicators as well. These activities can also be supported by implementation of strategies identified under the NAP.

The following subsections provide simplified hypothetical examples to illustrate how this link could be made between these output indicators and NAP strategies. These examples are intentionally simplified to demonstrate the concept. The approach for a given country project would need to be more detailed and tailored to country circumstances, with justification. All calculations should be transparent, justifiable and in line with the NAP.

3.1.2.1 Indicator 2: Number of miners assisted with formalization

Total number of miners by end of project	Result by planetGOLD intervention type	Level of effort Multiplier (based on mercury abatement)	Additional activity needed to achieve additional impact	Corresponding NAP strategy
10,000	2 cooperatives	2	At least 4 cooperatives to be	Facilitate the

miners	assisted with formalization and permitting		assisted with formalization and permitted	issuance of ASGM permits in all ASGM areas
	10,000 miners given training on formalization	2	At least 20,000 miners to be trained	Strengthen the capacities of mine producers for general improvement and compliance with their obligations

3.1.2.2 Indicator 3 Amount of money made available

Total amount of money mobilized	Result by planetGOLD intervention type	Level of effort Multiplier	Additional activity needed to achieve additional impact	Corresponding NAP strategy or known initiative
1 million USD	$500,000 amount mobilized through one project-supported revolving fund	2	At least 2 new mechanisms of equal size (or doubling size of existing mechanism)	Increase miners' capacity to reduce mercury use in the ASGM sector through the establishment of the Miners Assistance Fund
	$500,000 amount mobilized through training 50 miners in finance, each who then accessed $10,000 on average from existing funding mechanisms	2	At least 100 miners trained on finance, resulting in $1 million accessed by miners from existing mechanisms	Provide training on basic finance and business practices for miners to facilitate access to loan mechanisms

Projects may reflect on the likelihood of this additional replication, for example if there are already other known/committed measures in place that will support results in the future: for example, cooperating financial institutions may have earmarked windows of financing for miners in the years to come.

3.1.2.3 Indicator 4 – Amount of responsible gold produced/ sold to formal markets

Market mechanisms are not a mandatory element of NAPs, but where such strategies are included, their further adoption after project end can be considered when estimating potential replication. For example, if production of a certain volume of gold has been promised under offtake agreements, this can be noted.

Total gold sold	Result by planetGOLD intervention type	Level of effort Multiplier	Additional activity needed to achieve additional impact	Corresponding NAP strategy or known initiative
100 kg gold sold to formal market	Developed of a mine to market supply chain with mining operation and international buyer	2	At least 2 new supply chain mechanisms developed	Introduce market-based mechanism to support responsible ASGM, such as OECD due diligence, Fairmined certification systems and voluntary reporting on environmental and social responsibility
	Provided training on CRAFT code to 25 mining operations, which resulted in one mining company qualifying as supplier for international buyer	2	At least 50 additional ASGM mining operations trained in CRAFT code	

3.2 Qualitative evaluation of the likelihood of replication

Projects may include a qualitative evaluation of the likelihood of replication and report this evaluation when reporting their replication analysis. This can be based on a qualitative evaluation of the strength of the project intervention. The final evaluation of the project can provide an external assessment of the project.

The project can also perform a self-assessment for the specific interventions, based on the following criteria:

- Effectiveness: How effective is/was the intervention? According to the OECD-DAC[14] definition, effectiveness refers to the *"extent to which the intervention achieved, or is expected to achieve, its objectives, and its results, including any differential results across groups."*)
- Sustainability (According to the OECD-DAC definition, sustainability refers to the *"extent to which the net benefits of the intervention continue or are likely to continue."*
- Size & Significancy of the intervention (How significant was / is the component / intervention compared to the entire programme)

Ratings could be assigned based on these criteria, from which a qualitative score for likelihood of replication (low, medium, high) could be derived.

Example Ratings:

Effectiveness	Sustainability	Significance	Points
Not effective	Sustainability unlikely	Not significant	1
Below average	Below average	Little significancy	2
Medium effectiveness	Medium Sustainability	Medium Significant	3
Good effectiveness	Good sustainability	Significant	4
Very effective	High sustainability	Very significant	5

Percentage of maximum points	Qualitative rating
0-60%	Low
60-80%	Medium
Above 80%	High

[14] Guidance on OECD-DAC criteria and how to use them are found on the internet, e.g.: https://www.oecd-ilibrary.org/development/applying-evaluation-criteria-thoughtfully_543e84ed-en

Example calculation:

	Effectiveness	Sustainability	Significancy	Points
Formalization interventions	4	3	3	10
Technology transfer	3	2	3	7
Financial access/training	3	5	4	12
Access to formal markets	4	4	5	13
			Total Points	42

In this example the project was self-assessed to have a rating of 42 out of the maximum number achievable are 60 points, or 70%, which would be a medium rating, meaning there is a medium probability of replication.

3.3 Tracking replication beyond project life

To gather information on the extent to which the required replication is achieved beyond the end of the direct intervention requires a solid ex-post impact assessment done 5 to 10 years after the end of the project. Such an impact assessment is highly recommended. Unfortunately, in practice, such an ex-post impact assessment is not done in most cases, due to the simple reasons that a project budget does not reach beyond the lifespan of the project. At the end, books must be closed and there are no funds available 5 – 10 years later; neither is a project management in place to organize or implement such an assessment.

In the case of the planetGOLD programme, however, there is a built-in mechanism for post-project monitoring of NAPs. planetGOLD participating countries are obligated to report to the Minamata Secretariat on NAP progress every three years. The NAPs also include the respective monitoring plans and approaches.

Therefore, (ex-post) monitoring of the country project and data-gathering and monitoring for the NAP should be done hand in hand, and NAP data used as much as possible and feasible to estimate the ex-post impact of the project.

Such ex-post evaluation could be carried out through execution of routine government duties, for example, through the inspection visits carried out by the National Mining Agencies, where data is collected on mining units in situ. Another option is for international NGOs or civil society networks active in the ASGM sector in the country to provide data relevant to the ex-post evaluation. Funds may also be potentially mobilized for its via international donors.[15] The project team, before the end of the project, can establish collaboration agreements in this regard. The data collected could then feed the NAP progress reports that the country must in any case submit every three years.

[15] for example, the GDIAM in Colombia or the GIT-OR in Bolivia.

Annexes:

Annex I: Examples of approaches to calculating gold production using indirect methods

As reported in Section 7.4. *Estimating Gold Production*, "*Estimating mercury use and documenting practices in artisanal and small-scale gold mining (ASGM): Methods and Tools*" (O'Neill and Telmer, 2017, hereafter referred to as the "mercury use toolkit") there are multiple ways to indirectly estimate gold production, where direct data from miners or buyers is not available or reliable. The document describes the extraction, processing and earnings-based approaches:

- The extraction approach uses information collected about ore extraction to produce estimates of ASGM gold production and workforce. In this scenario the team should gather information about the number and type of extraction units in the region, the typical ore production per extraction unit or miner, and the number of extraction units or miners per site.[16]
- The processing approach uses information collected about ore processing to produce estimates of ASGM gold production, mercury use, and workforce. The baseline team should gather information about the number and type of processing units in the region, the typical throughput of each processing unit, and the number of processing units per site.[17]
- The earnings-based approach uses information collected about stakeholder income to produce an estimate of ASGM gold production or workforce. Information should be gathered about the distribution of revenue between stakeholders for a specific venture (extraction/processing unit, business, ASGM site), and the number of a certain type of stakeholder (e.g., extraction workers or mine owners) to produce an estimate of total earnings. If earnings are reported in grams of gold, then the estimate of gold production is known. If it is in local currency, an understanding of average gold purity and gold price will yield gold production.[18]

The following provides some examples of approaches to calculating gold production, using the processing approach, for hard rock and alluvial settings. Examples are adapted from the mercury use toolkit.

Hard Rock

To estimate the amount of gold produced by a given hard rock mining operation annually, a common method is the "production" method. Using this method, the amount of gold produced per day Au_{daily} can be estimated using the following information:

[16] (O'Neill and Telmer. 2017. Pg. 70)
[17] (O'Neill and Telmer. 2017. Pg. 71)
[18] (O'Neill and Telmer. 2017. Pg. 72)

Variable	Acronym	Unit	Definition
Daily gold production	Au_{daily}	Grams per day	Amount of pure (24K/100%) gold produced in a day[19]
Amount ore processed	T_{ore}	Tonnes per day	Amount of ore processed per day
Average recoverable grade of the ore	G_{ore}	Grams per tonne	Recoverable grade is the amount of gold extracted by the miners using their processing method

$$Au_{daily} = T * G$$

Example: How much gold is yielded from 30 T of ore processed per day that has a recoverable grade of 5 g/T?
Gold Produced = (30 T/day) * (5 g/T) = 150 g of gold per day

To calculate annual production, this daily amount can be multiplied by the number of days per year that the unit operates. Where there is more than one unit of a given type in the target area, the amount of gold produced by one mill can be multiplied by the number of mills with similar capacity:

$$Au_{produced} = T * G * \text{number of days operating/year} * \text{number of units of given type}$$

This calculation can be conducted for each type of unit operating at the intervention site affected by the intervention. (ball mills, stamp mills, shaking tables, etc.)

Example: How much gold is produced per year if:
- 150 g of gold are yield per day per unit (see above)
- a unit runs 180 days per year
- there are two units (of similar capacity) operating in the target area?

Gold Produced = 150g/day/unit * 180 (days/year) * 2 (units) = 54,000 grams per year

Data sources:

- Tons processed per year: The amount of ore processed can be based on the operating parameters of a given unit (tons per day capacity multiplied by the percent capacity at which the unit is operating). For central processing centers, the amount of ore can be estimated based on the amount of ore that the miners bring to the processing site per unit time (e.g. Indonesia records the number of "sacks" of

[19] For the sake of standardization and to allow comparison between different operations, the mercury use toolkit uses 24K=100% purity scale and proposes a calculation for correcting impure gold to the 24K/100% pure equivalence. See Annex A4. ASGM equations and example calculations of the mercury use toolkit, available at https://shorturl.at/quDPQ

ore (approx. 40kg each) brought by the miners to centralized processing.)

Generally, it can be assumed that 100% of the capacity of a newly installed mercury free equipment will be used by miners, absent actual use information is available that demonstrates otherwise.

- Grade: Miners at a given operation often know or can estimate their average recoverable grade. If the information is not available from the miners, the project should do their own sampling and testing. Testing of tailings can also give an indication of the recoverable grade of gold (in %) when head grade is known[20].

Alluvial

For alluvial operations, the amount of gold produced is equal to the amount of material passed over the sluice ("slurry throughput") in a given time period (day), times the average grade of that material. To calculate slurry throughput, readers are referred to Annex A4. Equations and Example Calculations, in the mercury use toolkit.

Miner reported production: The production methods described above cannot be applied when miners process inconsistent amounts of material per unit time, and/or work with material with high variability of gold content through selection of the material. In such cases, the project may be able to use estimates of production provided by miners themselves, for average gold production per miner or per group per day. These estimates may be triangulated using the "earnings" method, described in section 7.4 of the mercury use toolkit, to check if the figures are reasonable. These figures can then be extrapolated annually by estimating the number of days a miner works per year and multiplied by the (estimated) average number of miners or groups in the project area targeted by the project.

$Au_{produced} = Au_{group} * N_{groups} * \textit{number of days operating/year}$

Where:

Variable		Acronym	Unit	Definition
Group gold production		Au_{group}	Grams per day	Estimated amount of gold produced per working group of miners
Number of Groups in the target area		N_{groups}	number	Number of groups in the target area with similar levels of operation

[20] In some specific cases, depending on the approach adopted by the country for the Hg reduction/avoidance, ore grade information can be obtained or cross-checked with that provided by other actors collaborating with the project, such as laboratories. This is the case in Ecuador, which also obtains information on gold produced from the mercury-free beneficiation plants strengthened by the project to which ASGM miners sell the material to be processed.

Annex II: Establishing the Hg:Au ratio

There are several ways to establish the Hg:Au ratio. Because the Hg:Au ratio for ASGM differs considerably depending on the mining and processing method used, ideally it should be estimated for each intervention if possible. Absent this, other information can be used, using the following hierarchy:

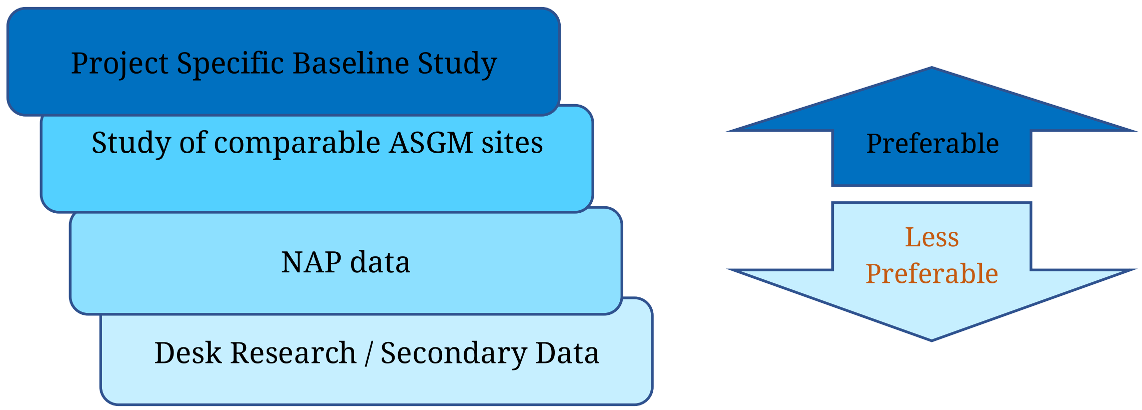


Figure 4: cascading approach to establish the Hg-Au ratio

Whatever way the projects choose to estimate the Hg:Au ratio, they must be transparent about the method, formula, limitations, and assumptions and justify why they have used the specific approach.

I. Direct Measurement at Intervention Site:

There are many factors that may affect the Hg:Au ratio, for example the type of ore, the practices and skills of the workers, the processing technology, etc. For this reason, the best source of the mercury:gold ratio is direct measurement at the intervention sites, and ideally an average of several measurements. These measurements can be done during the project-specific baseline study during the design phase of the intervention, as well as post-intervention, in cases where less mercury intensive (but not mercury-free) methods are introduced.

The Hg:Au ratio should have been established as part of this study, using the data and information provided directly by members of the target groups of mining operations or observed, calculated and/or physically measured by the project directly on-site. The steps are as follows (adapted from the mercury use toolkit):

1. Convert the weight of the sponge gold[21] into equivalent mass of pure* (24K, 100%) gold using the average reported gold purity on site.[22]
2. Calculate the total mercury used as the total mercury added to the ore minus the mercury recovered by recycling and by retorting (either onsite or at a gold shop).
3. Divide the total mercury used by the mass of pure gold produced:

Hg:Au ratio = (Hg added – Hg recovered) / (mass of gold produced)

[21] "Sponge gold" is produced when the amalgam ball is heated to vaporize the mercury (O'Neill and Telmer. 2017)

[22] O'Neill and Telmer. 2017. Estimating Mercury Use and Documenting Practices in ASGM. Section 7.4.3

II. Specific studies of comparable operations in the project area

If it is not feasible to collect data collection or measurements from each project site, it is possible to use field-based measurements of comparable ASGM operations in the project area, where comparably mercury-intensive methods are used.

III. Secondary data

The Hg:Au ratio may be difficult to establish through a study directly in the field, either at the project site or nearby comparable site, for example where miners do not/cannot provide information on the amount of mercury used or deny the use of mercury entirely, because the use of mercury is illegal (e.g., in Mongolia, Colombia, others).

In such cases, the Hg:Au ratio must be established using secondary data from available public sources. An important source of information is the NAP. In some cases, other literature may also need to be consulted.

Data from NAP, calculated using the UNEP guidelines: For most of the countries included in Phase 1 of planetGOLD, the development of a National Action Plan (NAP) is underway or has been completed by the start of the project (see https://www.mercuryconvention.org/en/parties/national-action-plans.) In Phase 2 and beyond, only countries with completed NAPs will be eligible to participate in the programme. Per Annex C of the Convention, all National Action Plans are required to include a baseline inventory on the use of mercury in ASGM. The development of the baseline inventory normally includes the use of Hg:Au ratio and gold production estimates across a range of locations and types of operations.

The relevant specific methods and assumptions (e.g., Hg:Au ratios, gold production assumptions) used in the country's NAP can inform project calculations as well. In principle, country projects should strive to be consistent with the NAP assumptions unless the project has collected its own primary data to estimate the Hg:Au ratio and gold production figures.

Data from other secondary sources: In rare cases where primary data cannot be established in the field for any reason, and data from the NAP are not suitable for the specific project situation, a project must do its own desk-research to find an appropriate Hg:Au ratio suitable for the individual project environment. Many studies on this issue, done in all ASGM regions around the globe can be found in the public domain. It is also notable that the UNEP mercury inventory toolkit (used to support MIAs) uses a default global Hg:Au value of 1.3:1 for concentrate amalgamation and 5:1 for whole ore amalgamation[23].

Hg:Au ratios differ significantly depending on the specific characteristics of the deposit and/or, the region, the mining method, technical capacity of the miners and of course on the processing method used in the area. Therefore, data collected from the literature must be match these project site characteristics as closely as possible.

[23] UNEP Toolkit for identification and quantification of Mercury releases, Reference Report and guideline for Inventory level 2. page 100. Practical guide on baseline estimates (Artisanal Gold Council, 2015).

Annex III: Example calculation to extrapolate over time

Below is an example of mercury abatement during project life (calculated) followed by 10 years of operation following project end (extrapolated).

Year	Mercury reduced/eliminated /prevented/avoided (t)	
Project year 1	0,0	calculated
Project year 2	0,03	
Project year 3	0,22	
Project year 4	0,72	
Final project year 5	1,23	
Post Project y 1	1,23	extrapolated
Post Project y 2	1,23	
Post Project y 3	1,23	
Post Project y 4	1,23	
Post Project y 5	1,23	
Post Project y 6	1,23	
Post Project y 7	1,23	
Post Project y 8	1,23	
Post Project y 9	1,23	
Post Project y 10	1,23	
TOTAL:	14,5	

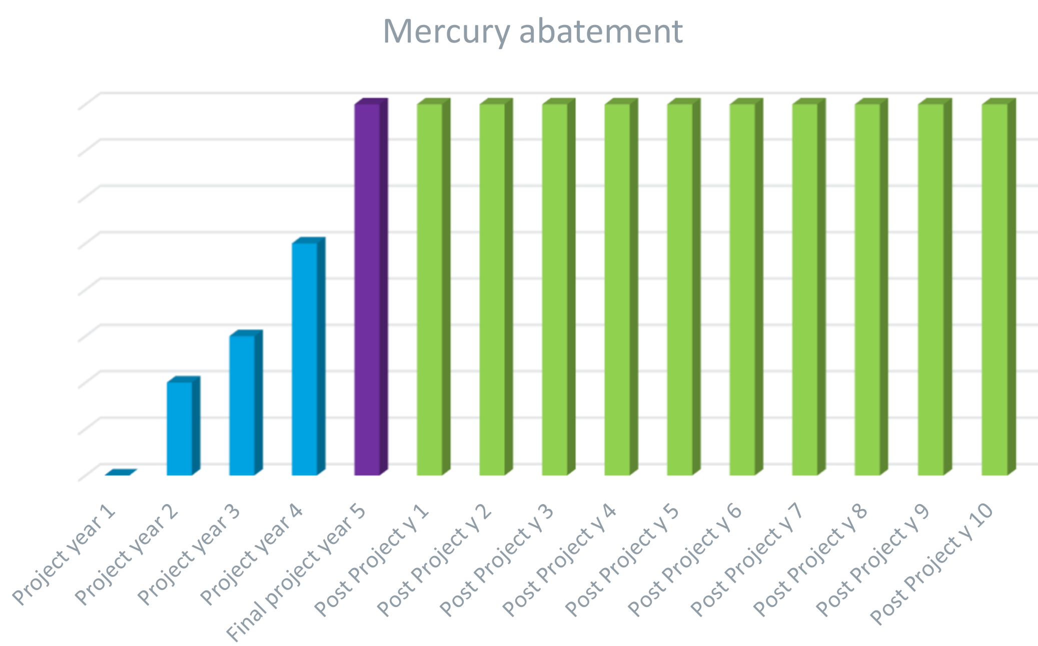


Figure 5: example extrapolation of data beyond the project's lifespan

Annex IV. Example Calculations For Cross-Programmatic Indicators

INDICATOR 1: Mercury Abatement

Example 1A: Alluvial Mining: Example Calculation for Mercury Reduced and Avoided

A 5-year planetGOLD country project worked directly with targeted groups of alluvial miners organized in cooperatives to introduce new technologies to increase production as well as the use of retorts and other means to significantly reduce the amount of mercury lost to the environment.

The baseline study (done during project preparation phase) established that on average:

- Alluvial miners use of 2.5 grams of Hg to produce 1g of gold.
- A typical group of 7 miners produces 10.5 g of gold per day
- Miners only work during the dry season from Monday to Saturday, or an estimated 130 days per year.

Mercury Reduced from Direct Technical Intervention

Based on surveys, tests and observations, the project reported that, using the new technologies:

- Miners increased gold production per day by 80%.
- Miners recover most of the mercury, however, 0.09 g of Hg per g of Au are still lost to the environment.

Project report further show that miners adopted the new technologies increasingly over the course of the project.

Year	Number of groups adopting the new technologies in technical intervention area (number/year)
1	0
2	12
3	30
4	75
5	85

To calculate mercury reduced, the following input parameters are used:

Input Parameters	Symbol	Prior to intervention (Baseline)	After intervention (Post)
Production/group/day	Au_{daily}	10.5	18.9
Increase in productivity	Au_{delta}	n/a	80%
Working days per year	d	130	130
Hg/Au ratio	U_{Hg}	2.5	0.09

Based on these inputs, the mercury reduced from direct technical interventions can be calculated as follows:

Year	Groups adopting the new technologies (#/year)	Baseline Au = Estimated gold production before intervention (g)	Baseline Hg Lost = Estimated mercury lost (Hg) to the environment before the intervention (g)	Post Au= Estimated gold production after intervention (g)	Post Hg Lost = Estimated mercury lost to the environment after intervention (g)	Hg reduced = Mercury reduction (g)
		Baseline Au = baseline Au_{daily}*d	Baseline Hg lost = Au * Baseline U_{Hg}	Post Au = Au_{daily}* Au_{delta} * U_{Hg}	Post Hg Lost = Post Au * Post U_{Hg}	Hg reduction = Baseline Hg Lost – Post Hg Lost
1	0	0	0	0	-	-
2	12	16,380	40,950	29,484	2,654	38,296
3	30	40,950	102,375	73,710	6,634	95,741
4	75	102,375	255,938	184,275	16,585	239,353
5	85	116025	290,063	208,845	18,796	271,266
Total after year 5	202	275,730	689,325	496,314	44,668	644,657

Mercury Reduced from Educational Interventions

In addition to these direct technical interventions, the project also provided awareness raising and training on the new methods to 340 miner groups (in years 2 and 3) in the project area.

A tracer study showed that 45 % of these miner groups adopted the new technologies after their training and are using them efficiently with their groups from year 4 onwards. (340 * 45% = 153 groups in years 4 and 5).

Using the same input parameters as above, the mercury reduced from educational interventions can be calculated as follows:

Year	Groups adopting the new technologies (#/year)	Estimated gold production before intervention (g)	Estimated mercury lost to the environment before the intervention (g)	Estimated gold production after intervention (g)	Estimated mercury lost to the environment after intervention (g)	Mercury reduction (g)
		Baseline Au = baseline Au_{daily}*d	Baseline Hg lost = Au * Baseline U_{Hg}	Post Au = Au_{daily}* Au_{delta} * U_{Hg}	Post Hg Lost = Post Au * Post U_{Hg}	Hg reduction = Baseline Hg Lost – Post Hg Lost
1	0	0	0	0	-	-
2	0	-	-	-	-	-
3	0	-	-	-	-	-
4	153	208,845	522,113	375,921	33,833	488,280
5	153	208,845	522,113	375,921	33,833	488,280
Total after year 5	306	417,690	1,044,225	751,842	67,666	976,559

The total mercury abatement during the life of the project (including technical interventions and educational interventions in surrounding areas) is 644,657 g + 976,557 g = 1,621,216, or 1.62 tons of mercury reduced.

Mercury Avoided from Technical Interventions

Extrapolation factor over time:

The direct technical interventions are expected to be maintained after project life and produce further mercury abatement for some time. For the groups benefitting from direct technical interventions, information is available from which an extrapolation factor can be justified: the miners are well-embedded in the local structures and the mining community is considered "stable" (no "gold-rush-scenario, hardly migration); there is sufficient ore in the ore body to support ongoing production at current levels; and the equipment provided is expected to last and/or can be locally repaired. Therefore, it can be assumed that these operations will continue to operate mercury-free for the maximum time of 10 years after end of project.

New technologies that are adopted by groups after training activities may also be maintained and thus deliver further mercury abatement over time; however, the project does not have sufficiently detailed information about those operations to justify an extrapolation factor over time. Therefore, the extrapolation factor is only applied to mercury abatement from direct technical interventions.

In summary, the mercury reduced from technical interventions during project life (calculated) will be followed by 10 years of operation following project end (extrapolated), based on the abatement observed at year 5 (the final project year, 271,266 grams or around 0.27 tons), as shown below:

Year	Mercury reduced (g)	
Project year 1	-	calculated
Project year 2	38,296	
Project year 3	95,741	
Project year 4	239,353	
Final project year 5	271,266	
Post Project y 1	271,266	extrapolated
Post Project y 2	271,266	
Post Project y 3	271,266	
Post Project y 4	271,266	
Post Project y 5	271,266	
Post Project y 6	271,266	
Post Project y 7	271,266	
Post Project y 8	271,266	
Post Project y 9	271,266	
Post Project y 10	271,266	
TOTAL Reduced and Avoided :	3,357,321	

Total mercury reduced and avoided from direct project interventions approximately 3.4 tonnes.

Example 1B: Hard Rock Mining: Example Calculation for Mercury Prevented & Avoided

A 5-year planetGOLD project set up two mercury free processing plants for hard rock ore in two mining communities.

The use of mercury is illegal in the country. However, there is sufficient evidence that mercury has been and still is used for whole-ore amalgamation in the region. In the absence of solid baseline data, a “standard” Hg-Au ratio of 5:1 for these illegal operations is used for this calculation.

- Each processing plant has a maximum capacity of 60 tonnes per day.
- Tests suggest that each plant is used in average at 90% capacity for 280 days per year.
- The average recoverable grade of the ore is 8g/t.

Mercury Prevented From Direct Technical Intervention

The amount of ore processed per plant per year is:

60t (ore max) * 90% (capacity usage) * 280 (days/year) = 15,120 tonnes of ore.

Using a grade of 8 g/t, this gives a gold production amount of

120,960g or 0.12 tonnes of gold per year per plant.

Using a Hg:Au ratio of 5:1 gives a capacity for mercury prevented of:

0.12 tonnes gold/year * 5 units Hg/1 unit gold = 0.6 tonnes per plant per year

Plant I was commissioned end of the 6th month of Year 3; Plant 2 was commissioned end of the 3rd month of Year 4.

Year	Operational period (years) Plant I	Gold Produced (t) (assuming 0.12/yr)	Mercury prevented Plant I (tonnes) (using 5:1 Hg:Au ratio)	Operational period (years) Plant II	Gold Produced (t) (assuming 0.12/yr)	Mercury prevented Plant II (tonnes) (using 5:1 Hg:Au ratio)
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	6 months = 0.5 years	0.06	0.3	0	0	0
4	1	0.12	0.6	9 months = 0.75 years	0.09	0.45
5	1	0.12	0.6	1	0.12	0.6
Total:	2.5	0.3	1.5	1.75	0.21	1.05

Considering both plants together, in total by the end of year 5, the plants produced 0.51 tons of gold and the project prevented 2.55 tonnes of mercury through direct technical interventions.

Mercury Prevented From Educational Interventions

In addition to direct technical intervention setting up two plants, the project also engaged in technical demonstrations, training and other educational activities for other mining groups in the area. Because of the technical education provided by the project and buttressed by the financial education conducted by the project, two local groups were inspired to set up two plants of similar capacity in other parts of the region, one owned by a cooperative (using a bank loan) and one set up by a private investor offering custom-milling for the ASGM operators in the area.

Both plants started operations at the end of year 4 of the project.

This means that in year 5, two more mercury-free plants are operating because of educational activities of the project/ As a result, an additional 0.12 tons of gold are produced by each plant and and additional 0.6 tons of mercury are prevented at each plant. For both plants, 0.24 tons of gold are produced and 1.2 tons of mercury is prevented from these two plants.

Mercury Avoided from Direct Technical Interventions and Educational Activities:

The total gold produced and total mercury prevented during project life from both direct interventions and educational activities is:

	Gold produced (t)	Hg prevented (t)
Plants with direct technical intervention	0.51	2.55
Plants set up by others after educational activities	0.24	1.2
TOTAL Mercury Prevented during Project Life	0.75	3.75

Extrapolation factor over time:

The mercury abatement from the two plants set up as direct project technical interventions are expected to be maintained after project life and produce further mercury abatement for some time. For the groups benefitting from direct technical interventions, information is available from which an extrapolation factor can be justified:

- the miners are well-embedded in the local structures and the mining community is considered “stable” (no “gold-rush-scenario, hardly migration);
- there is sufficient ore in the ore body to support ongoing production at current levels; and
- the equipment provided is expected to last and/or can be locally repaired.

The two plants set up independently by other groups (after receiving training/education from the project) can also be expected to produce mercury abatement after the end of the project. In this case, because the project has information on the design, operational parameters, ownership structure and other information regarding these two plants, there is sufficient information to justify an extrapolation factor for these operations as well.

Therefore, it can be assumed that all of four of these operations will continue to operate mercury-free for the maximum time of 10 years after end of project.

In summary, mercury prevented during project life (calculated) will be followed by 10 years of operation following project end (extrapolated). The extrapolation is done on the basis of year 5 (the final project year), when 0.6 t of Hg is prevented by each of the four plants plant, and thus 2.4 t Hg is prevented/year for all four plants.

Year	Mercury prevented / avoided (t)	
Project year 1	0	calculated
Project year 2	0	
Project year 3	0.3	
Project year 4	1.05	
Final project year 5	2.4	
Post Project y 1	2.4	extrapolated
Post Project y 2	2.4	
Post Project y 3	2.4	
Post Project y 4	2.4	
Post Project y 5	2.4	
Post Project y 6	2.4	
Post Project y 7	2.4	
Post Project y 8	2.4	
Post Project y 9	2.4	
Post Project y 10	2.4	
TOTAL:	27.75	

INDICATOR 2: Number of miners supported in formalization efforts

Example for direct assistance and training and awareness raising on formalization:

A five-year planetGOLD country project worked directly with 12 cooperatives with a total of 860 active members[24] to support them in their formalization efforts. 60% of them are women.

Additionally, the project offered various formalization campaigns in other parts of the region for representatives of mining cooperatives as well as awareness campaigns for affected communities. The training and awareness raising reached representatives of 86 cooperatives with a total of 6.800 members. According to the information collected at the start of each training, 55% of these members are female. Using this information, the number of miners supported in their formalization are:

Miners supported in the formalization	female	male	TOTAL
Directly targeted for formalization assistance	860 * 60% = 516	860 * 40% = 344	860
Trained and supported through educational activities	6,800*55%= 3,740	6,800*45%= 3,060	6800
TOTAL	4256	3404	7660

[24] In this case, all members are equal, everybody working in the mine is an “equal member” of the cooperative.

Optional indicator: number of miners formalized

Data collected in the final evaluation in year 5 suggests that 65% of the trained and supported cooperatives are indeed successfully formalized or are about/likely to get formalized in the near future. As an optional indicator, the project reports the number of miners successfully supported in formalization:

Miners supported in the formalization	female	male	**TOTAL**
Directly targeted	860 * 60% = **516**	860 * 40% = **344**	860
Trained and supported	6,800*55%*65%= **2,431**	6,800*45%*65%= **1,989**	4420
TOTAL	**2,947**	**2,333**	**5,280**

INDICATOR 3: Responsible gold produced/ sold to the formal market

Indicator 3A: Responsible Gold Produced

In Example 1B above, by end of project, the miners receiving direct technical intervention produced around (0.30+0.21=) 0.51 T of gold using mercury-free methods, while those receiving training/awareness raising activities produced around (0.12+0.12=) 0.24 T of gold using mercury-free methods, for a total of (0.51+0.24=) 0.75 T of mercury-free gold produced by end of project.

Year	Gold produced (t)			
	Direct intervention plants		Plants set up by Others after Training	
Project year 1	0	0	0	0
Project year 2	0	0	0	0
Project year 3	0.06	0	0	0
Project year 4	0.12	0.09	0	0
Final project year 5	0.12	0.12	0.12	0.12
TOTAL (cumulative during life of project):	0.3	0.21	0.12	0.12

However not all of this gold can be considered "responsible gold." To meet the definition of "responsible," operations must conform with the *'planetGOLD Criteria for Environmentally and Socially Responsible Operations'*. For those plants for whom the project provided direct technical intervention, the project also provided training on the Criteria and assistance in documenting their conformance with the Criteria. By end of project, both operations had sufficient documentation to show conformance with the Criteria.

Therefore, 0.51 t gold produced by these groups can be considered responsible gold, as of end of project. Assuming the plants remain in conformance for the rest of their operating lives (assumed to be 10 years), the responsible gold produced over the course of 10 years will equal an additional 2.4 tonnes (=0.12 per year per plant* 2 plants* 10 years), for a total of 2.9 t of responsible gold produced from direct technical intervention of the project.

For the two plants established by other groups, those who set up these plants participated in project-sponsored training and awareness raising on the planetGOLD criteria but the project did not provide any specific assistance to these operations to help document their conformance. By end of project only one plant had documentation of conformance with the Criteria. Therefore, only 0.12 t of gold produced by the conforming plant can be considered responsible gold, as of end of project. Assuming the plant remains in conformance for the rest of its operating life (assumed to be 10 years), the responsible gold produced over the course of 10 years will equal an additional 1.2 tonnes (=0.12 per year per plant* 1 conforming plant* 10 years).

Indicator 3B: Responsible Gold Sold to the Formal Market

In the example above, the project worked to find international buyers and create a formal traceable supply chain for the two plants that received direct technical intervention and assistance with documenting conformance with the planetGOLD criteria. Therefore, the 2.9 tonnes of responsible gold produced by these plants is considered sold to the formal market.

The destination of the gold sold from the two plants established by others cannot be verified by the project and therefore it cannot be determined if this gold was sold to the formal market.

INDICATOR 4: Amount of money made available

Example: Money made available through new financial mechanisms for miners

The project liaised with two micro-credit institutions in the target area. After working with these institutions about the potential benefits of providing financial services to the ASGM sector, the institutions agreed to create special loan facilities for ASGM miners, earmarking up to US$ 600,000 ($300,00 each) for this purpose. The project helped to design the loan products to fit the special needs of miners. Individual loans for each miner were capped at US$5000. The funds were meant to support equipment and working capital for the miners, to support responsible mining.

Some miners enthusiastically accessed these funds, while others were reluctant toe engage with formal financing for various reasons. Therefore, although $600,000 was made available, only US$ 250,000 was accessed by miners, representing $5000 loans to 50 miners. Microfinance records show that 20% of these miners were women, and 10% of the loans were made to indigenous people.

In this case, the results can be reported as:

Number of new financial mechanisms developed by the project to provide access to finance for responsible ASGM	2 ASGM microfinance loan facilities

Amount of money available for miners/ ASGM operations through those mechanisms (cumulative, in USD equivalent).	$600,000
Amount of money accessed by miners/ASGM operations via those mechanisms (cumulative, in USD equivalent).	$250,000
Number of miners receiving finance from mechanisms developed/ supported by the project over the lifetime of the project. ○ Male ○ Female ○ Indigenous	50 total: Male: 80%, or 40 miners Female: 20% or 10 miners Indigenous: 10%, or 5 miners
Average amount of finance received per miner	$5000
Use of proceeds	Equipment and working capital

Example: Money made available through new financial mechanisms for mining operations

The project set up two successful pilot plants which were able to demonstrate the technical feasibility and potential profitability of such operations. In parallel, the project cooperated closely with local banks to help them gain a better understanding of the mining sector. Through these efforts: one bank agreed to give a loan of US$ 500,000 to an indigenous-owned cooperative to establish its own mercury-free processing plant, and another bank gave a loan of US$ 650,000 to the male private investor to co-finance construction of a mercury-free custom-milling facility. In this case, the results can be reported as:

Number of new financial products supported by the project to provide access to finance for responsible ASGM over the life of the project.	2 loans to ASGM operations
Amount of money available for ASGM operations through those mechanisms (cumulative, in USD equivalent).	$1.100,000
Amount of money accessed by ASGM operations via those mechanisms (cumulative, in USD equivalent)	$1.100,000
Number of mining operations receiving finance from mechanisms developed/ supported by the project over the lifetime of the project. ○ Male ○ Female ○ Indigenous	2 total: 1 male-owned 1 Indigenous-owned
Amount of finance received per mining operation	$500,000 for indigenous cooperative $600,000 for custom

	milling operation
Use of proceeds	Equipment and engineering assistance for plant set up

Example: Money made available through educational activities

A 5-year planetGOLD country project performed a review of existing financial products at local financial institutions that could be accessed by ASGM. This review uncovered the existence of a special government-backed fund for women-owned small and medium size enterprises, which could be accessed through a local rural bank. The $500,000 fund was designed to provide loans of up to $10,000 to qualifying enterprises.

The project delivered a series of business/financial training classes for women miners in the project intervention area, which showed the participants the kind of business records and information required to meet the bank qualification requirements. The project also helped the miners to fill out the loan applications. As a result, 100 women miners in the project intervention area were able to access loans from this existing fund.

In this case, the educational impacts of the project can be reported as:

Amount of money accessed by miners from existing financial mechanisms after receiving training from the project (cumulative, in USD equivalent)	$100,000
Number of miners receiving finance (disaggregated by gender and noting if recipients were indigenous people)	100; 100% female
Average amount of finance per miner (in USD equivalent).	$10,000

Annex V: List of annual reporting indicators

Notes:
Reporting should provide data on indicators for impacts in the reporting year as well as cumulative impacts (i.e. since the start of project intervention).

All indicators should be accompanied by supporting evidence.

INDICATOR 1: Mercury reduced/avoided (complete whichever apply)

Impacts from technical intervention

- Amount of Hg reduced (in tonnes)
    - Attach calculations and justifications
- Amount of Hg eliminated (in tonnes)
    - Attach calculations and justifications
- Amount of Hg prevented (in tonnes)
    - Attach calculations and justifications
- Amount of Hg avoided (in tonnes)
    - Attach calculations and justifications

Impacts from educational interventions

- Amount of Hg reduced (in tonnes)
    - Attach calculations and justifications
- Amount of Hg eliminated (in tonnes)
    - Attach calculations and justifications
- Amount of Hg prevented (in tonnes)
    - Attach calculations and justifications
- Amount of Hg avoided (in tonnes)
    - Attach calculations and justifications

INDICATOR 2: Miners supported in formalization (complete whichever apply)[25]

Impacts from direct interventions

- Total number of miners supported in their formalization process
    - Note type of support
  - Number of female miners supported in their formalization process
    - Note type of support
  - Number of male miners supported in their formalization process
    - Note type of support
- Total number of mining operations supported in their formalization process
    - Note type of support
  - Number of female-led mining operations supported in their formalization process
    - Note type of support
  - Number of male-led mining operations supported in their formalization process
    - Note type of support

Direct impacts: optional indicator

- Number of miners/mining operations directly supported by project who have met all ASGM legal requirements
  - Number of female-led mining operations directly supported by project who have met all ASGM legal requirements
  - Number of male-led mining operations directly supported by project who have met all ASGM legal requirements

Impacts from educational activities

- Total number of miners supported in their formalization process through training and awareness raising activities only
    - Note type of support
- Number of female miners supported in their formalization process through training and awareness raising activities only
    - Note type of support
- Number of male miners supported in their formalization process through training and awareness raising activities only
    - Note type of support

[25] National projects should use the unit that is most applicable to the intervention (either the number of miners or the number of mining operations). In countries where ASM miners themselves are registered as individuals, the number of miners shall be counted. In countries where ASM cooperatives/operations are registered, mining operations will be counted (as the operations and not the individual miners are subject to formalization).

- Total number of mining operations supported in their formalization process through training and awareness raising activities only
    - Note type of support
- Number of female-led mining operations supported in their formalization process through training and awareness raising activities only
    - Note type of support
- Number of male-led mining operations supported in their formalization process through training and awareness raising activities only
    - Note type of support

INDICATOR 3: Responsible gold produced and/or sold (complete whichever apply)

Impacts from technical interventions

- Amount of responsible gold directly produced by operations verifying conformance with the planetGOLD Criteria (kilograms)
- Amount of responsible gold directly produced by operations verifying conformance with the planetGOLD Criteria, sold to a formal market or buyer (kilograms)

Impacts through educational activities

- Amount of verified responsible gold produced by entities that received only training and awareness raising support from the project (kilograms)
- Amount of verified responsible gold produced by entities that received only training and awareness raising support from the project, sold to a formal market or buyer (kilograms)

INDICATOR 4: Amount of money made available (complete whichever apply)

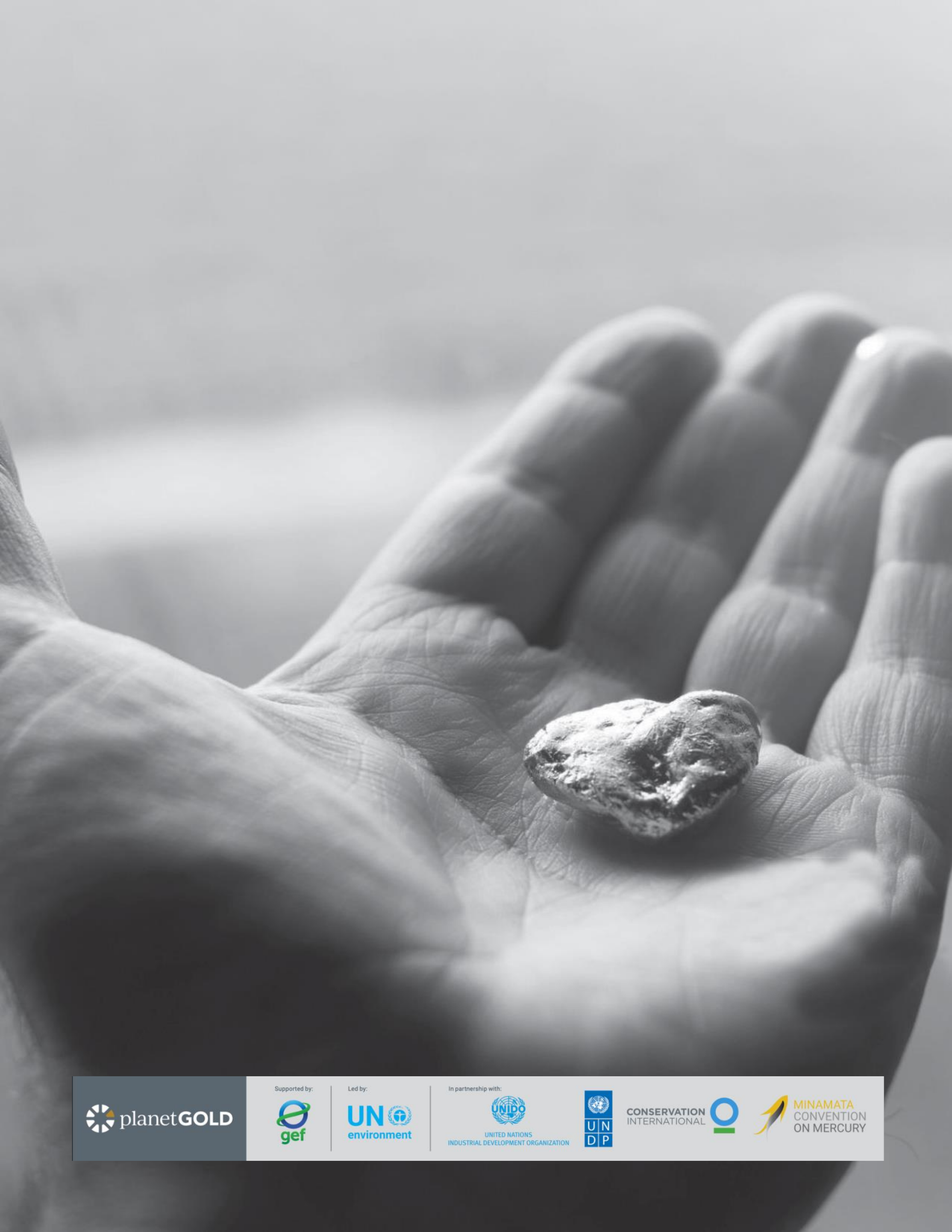
Impacts from the development of financial products/mechanisms

- Number of new financial products and/or mechanisms for ASGM *developed/supported* by the project
- For financial mechanisms, total amount of money *available* through the mechanisms (USD)
- Total amount of money *successfully accessed* by miners/operations via these products/mechanisms (USD)
- Total number of miners/operations who received money via these products/mechanisms
    - Total number of female miners/ female-led operations who received money via these products/mechanisms
    - Total number of male miners/ male-led operations who received money via these products/mechanisms
    - Total number of indigenous persons/ indigenous-led operations who received money via these products/mechanisms
- Average amount of money each miner received (USD)

        - Note how the funds were used (if known)
    - Average amount of money each female miner/female-led operation received (USD)
        - Note how the funds were used (if known)
    - Average amount of money each male miner/male-led operation received (USD)
        - Note how the funds were used (if known)
    - Average amount of money received by each indigenous miner/indigenous-led operation (USD)
        - Note how the funds were used (if known)

Educational impacts

- Total amount of money successfully accessed by miners/operations after project training/capacity building related to existing financial products/mechanisms (USD)
- Total number of miners/operations who received financing after project training/capacity-building
    - Total number of female miners/female-led operations who received financing after project training/capacity-building
    - Total number of male miners/male-led operations who received financing after project training/capacity-building
    - Total number of indigenous miners/indigenous-led operations who received financing after project training/capacity-building
- Average amount of money received per miner (USD)
    - Average amount of money received per female miner/operation (USD)
    - Average amount of money received per male miner/operation (USD)
    - Average amount of money received per indigenous miner/operation (USD)



planetGOLD

Supported by: gef

Led by: UN environment

In partnership with: UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNDP

CONSERVATION INTERNATIONAL

MINAMATA CONVENTION ON MERCURY