METHODS AND TOOLS

DETERMINING MERCURY USE IN THE ARTISANAL AND SMALL-SCALE GOLD MINING (ASGM) SECTOR

ARTISANAL GOLD COUNCIL

gef

UN environment

Lecture 3
Collecting Baseline Information

Collecting Baseline Information:
Tools, Techniques and Approaches

Overview

- Sources of Information
- National Level Scoping
- Field Data Collection Approaches
  - Observations and General Descriptions
  - Interviews
  - Counts and Measures
  - Physical Tools for Data Acquisition
- Data Analysis
- Step by Step Approach

Sources of information

- Literature
- Stakeholders
- Official export data
- Physical measurements
- Universities
- NGOs
- Donor Agencies (GEF GOLD, World Bank, GMP)
- Others?

- National & Regional Government
  (Mines & Environment)
- LSM
- Local Authorities
- Municipalities
- Mining Groups
- Gold Buyers & Exporters
- **MINERS!**

1. National Sector Scoping

Literature Review

Official trade data, peer-reviewed journals, white papers from LSM, NGOs, GMP, World Bank, GEF GOLD

Interviews with Stakeholders

Government (Mines, Environment, etc), NGOs, Universities, LSM companies, national gold buying houses, gold exporters

Visits to the capital & major mining hubs

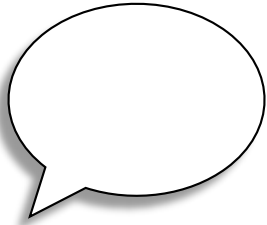Regional & municipal government offices, mayors office, regional gold traders, mining cooperatives

Visits to a few ASGM sites

On-the-ground realities, technology, access

1. National Sector Scoping

Literature Review

Interviews with Stakeholders

Visits to the capital & major mining hubs

Visits to a few ASGM sites

1. National Sector Scoping

Literature Review

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Visits to the capital & major mining hubs

Visits to a few ASGM sites

1. National Sector Scoping
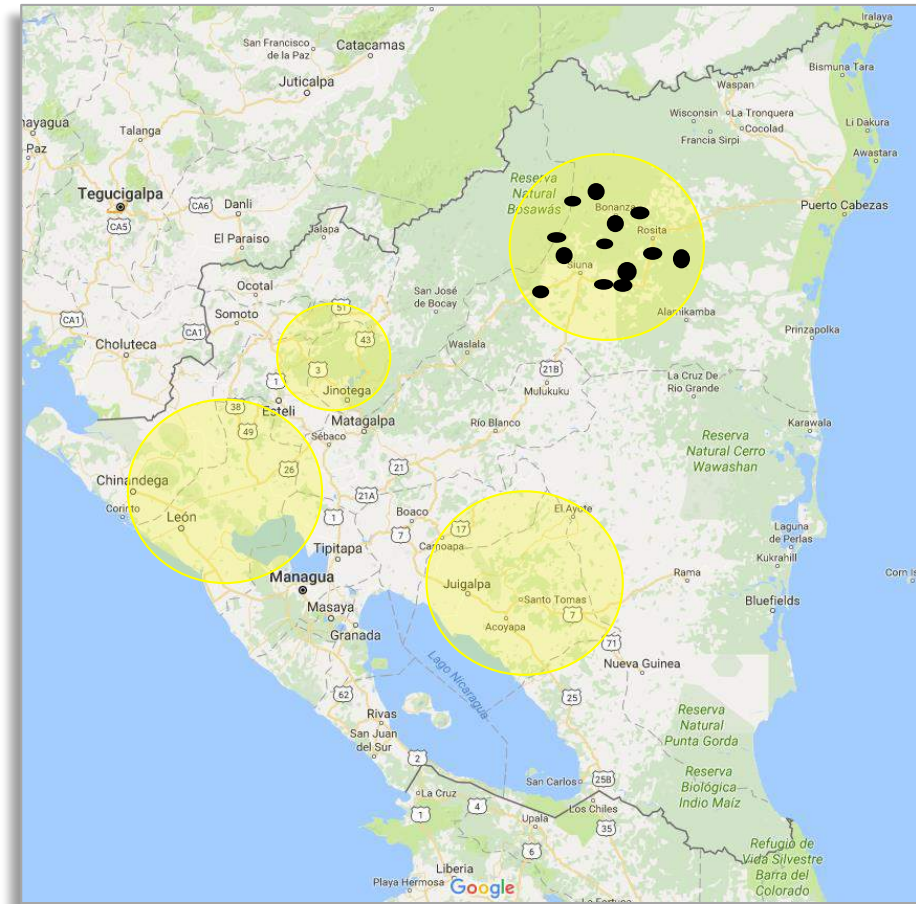

Literature Review

Interviews with Stakeholders

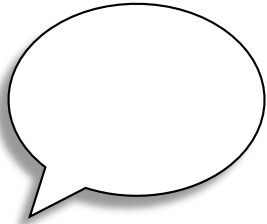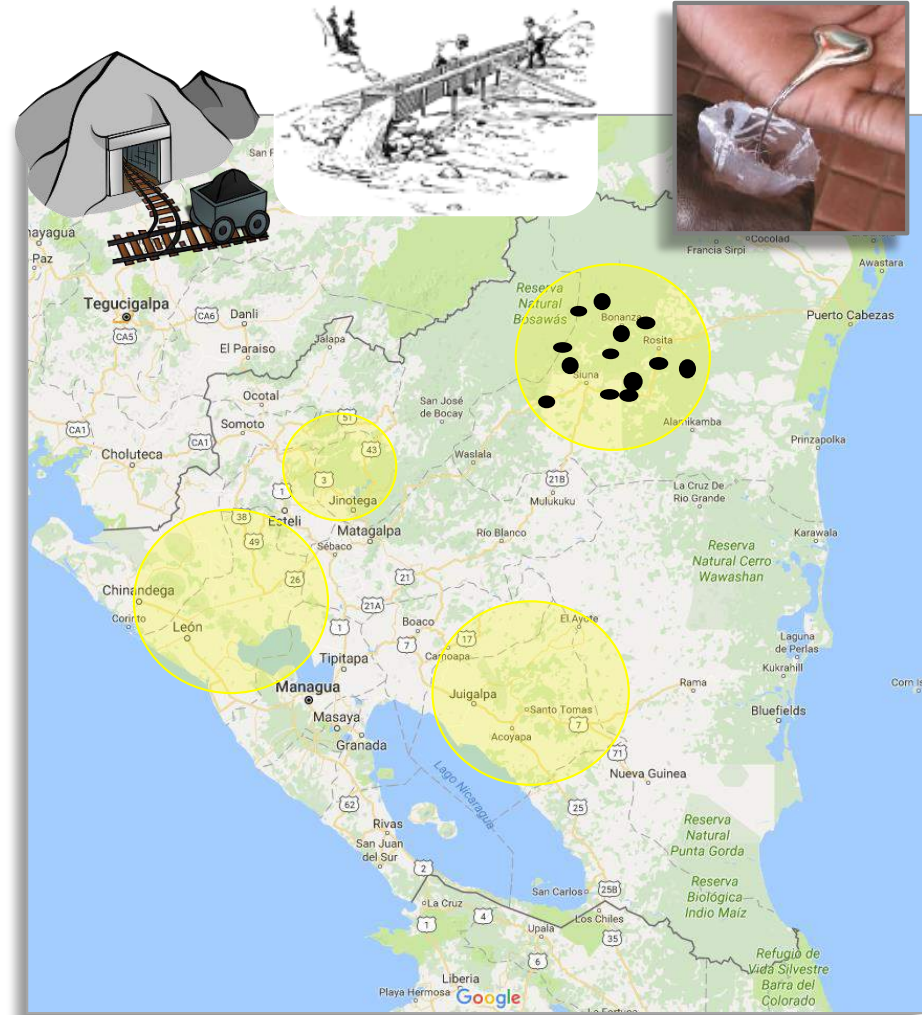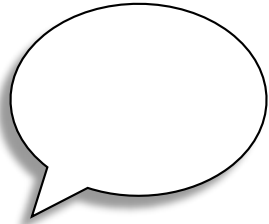Visits to the capital & major mining hubs

Visits to a few ASGM sites

1. National Sector Scoping

Literature Review

Interviews with Stakeholders

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Visits to a few ASGM sites

1. National Sector Scoping

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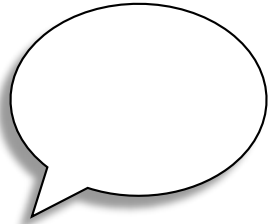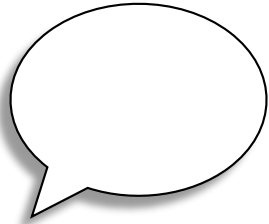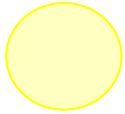
Visits to a few ASGM sites

2. Design a Research Plan
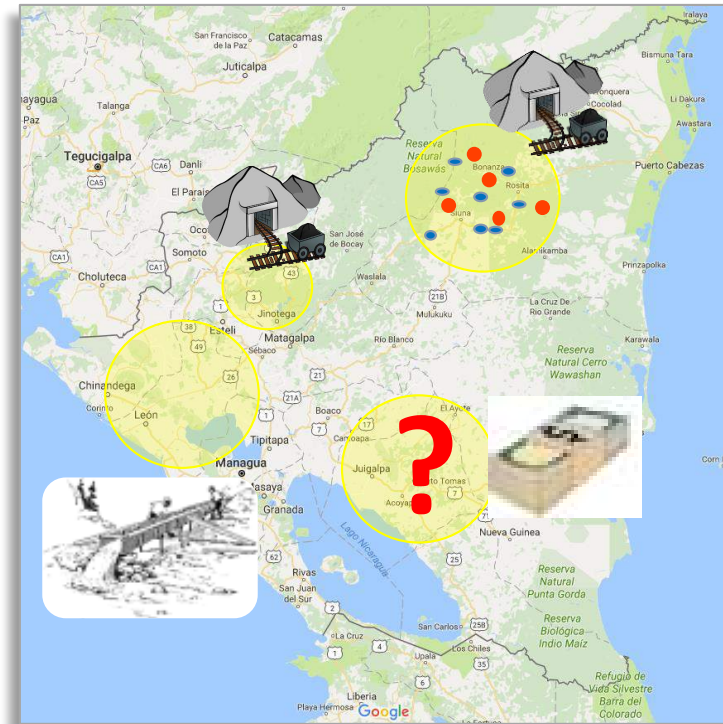

Identify regions & region data

Identify missing data

?

Select approaches *per region*

Determine information needed

Outline Field Data Collection

3. Collecting Field Data

Tools

General Site Assessment Form (to be completed inventory specialist based on observations)

Note: If there is a person in charge of the site (from the town/council, police, concession holder, etc) then they should be interviewed and if possible assist in collecting the information on this sheet.

General Site Information

General Information	
Inventory Officer:	Date:
Region:	Closest Community:
Site Name:	GPS: X Y Datum:
Estimated Site Workforce:	Style of Mining:
Processing style:	Formal Status on site:
How many gold buyers in community:	Evidence of mercury use:
Contact information:	
General Description of Site:	
...	
General Description of site Governance (Individual? Groups? Bosses? Do miners rent systems, do they get daily wage, % of production, Etc):	
...	

Extraction Information

Extraction Information	
Type of Ore: Hard Rock / Soft Rock / Both	Extraction Teams: Individual / Group / Both
Extraction Method:	Estimated total Miners on site:
# Open Pits:	# Shafts:
# Miners per open pit:	# Miners per shaft:
Open pit extraction method:	Shaft extraction method:
Daily extraction per miner (open pit):	Daily extraction per miner (shaft)
Unit of measure and weight per unit:	Days active per year:
Extraction Comments:	

Processing Information

Processing Information 1 (Do for each general processing workflow observed on Site)	
Type of Processing system:	
# of processing systems:	Estimated total Processors for this style system:
# Processors per system:	Throughput per system:
Is mercury used in upgrading?	Whole ore or concentrate amalgamation:
Comments/ description of processing workflow:	

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Step by Step Approach

1. Visit Regional Stakeholders
2. Visit Mining Communities
3. Meet Authorities
4. Visit extraction / processing sites
5. Casual introductions
6. Observations
7. Worker Interviews
8. Other local interviews?
9. Revise and compile data daily
10. Site and regional estimates
11. Adjust as necessary!
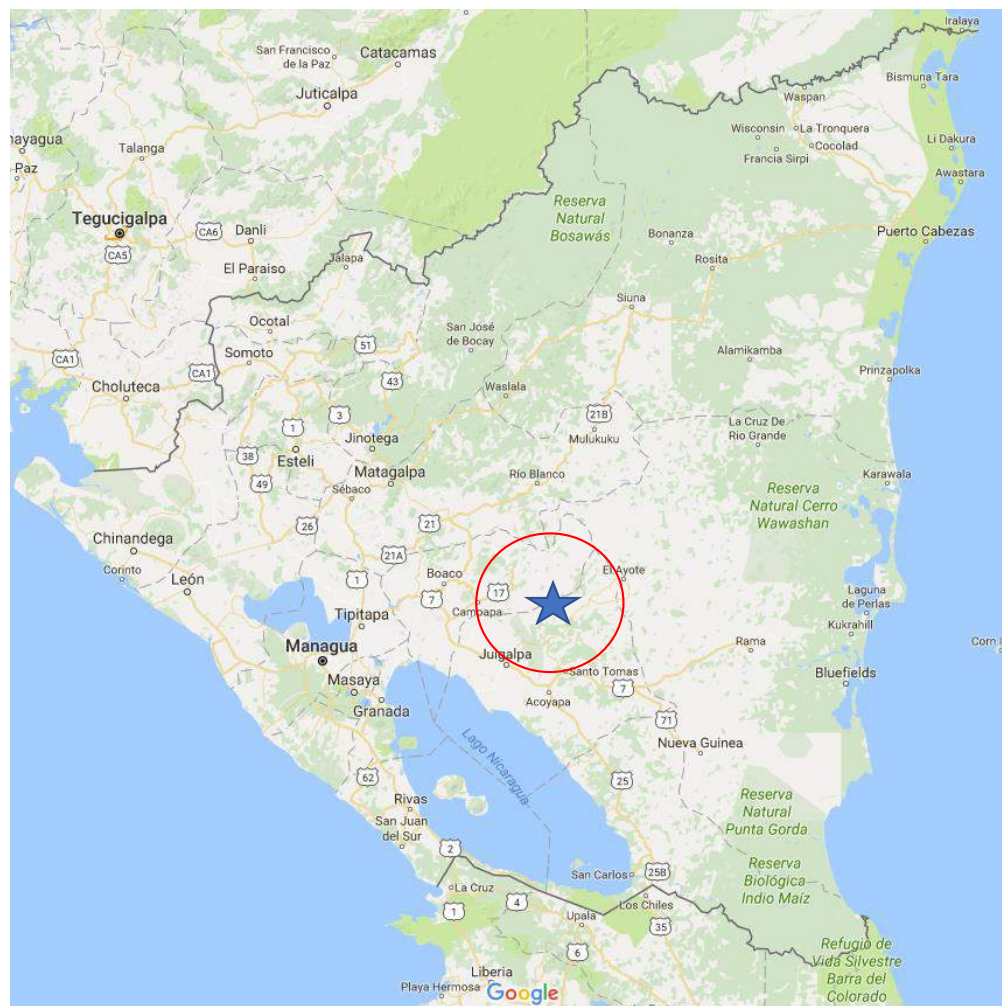
Step-by-Step Approach

Capital & Access Town

1. Meet with government and administrative officials + local authority. Explain project & obtain permission
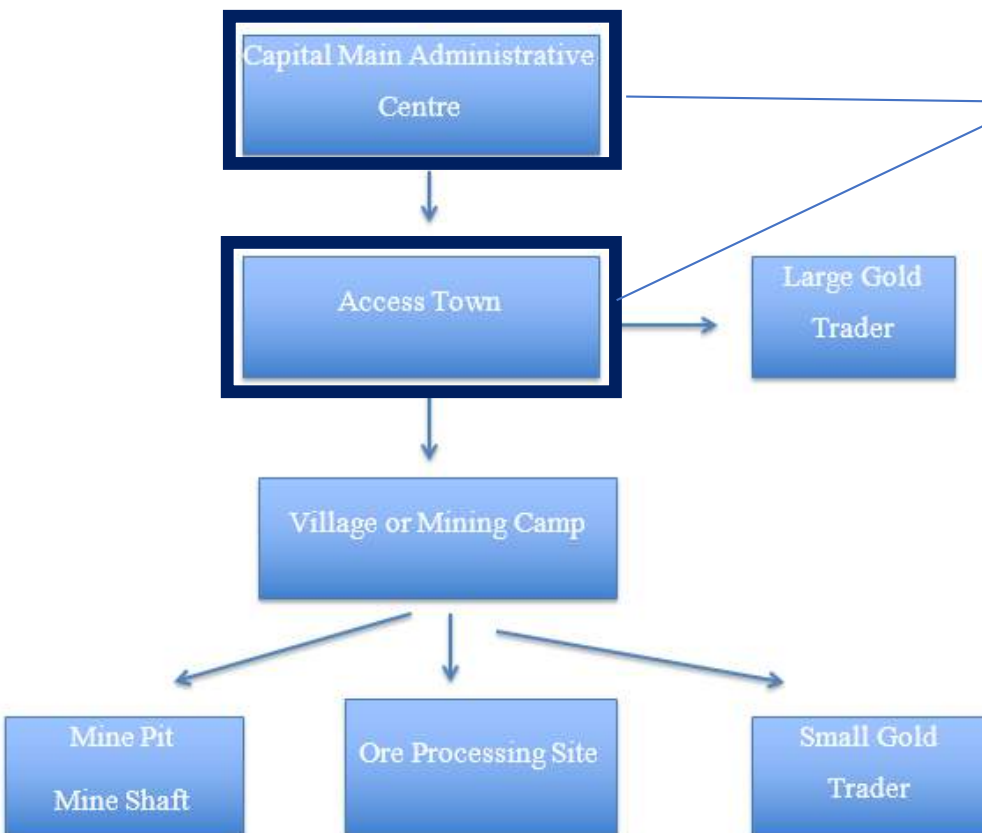
Step-by-Step Approach

Community

Step-by-Step Approach diagram

```
Capital Main Administrative Centre
        |
        v
Access Town  ------>  Large Gold Trader
        |
        v
Village or Mining Camp
   /      |      \
  v       v       v
Mine Pit   Ore Processing Site   Small Gold Trader
Mine Shaft
```

1. Meet with local authority
2. Explain project
3. Community Interview Form
   collect info about mining here
   (will be general)

Village or Mining Camp Data Form

Location			
Name of Village/Camp		Latitude	
Name of Mine Site		Longitude	
Province		Date	
Department/County		Time	
Site Accessibility			
Access Route (Description)		River A	

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A Note on Interviews

- Informal is better
- Build relationship and trust first
- Best to isolate one person for the interview
- **It`s a conversation**
- Ask questions first, take notes later
- Ask different questions to allow you to come to the same answers different ways
  - Evaluate answers as you go!
- Do NOT simply read questions off a sheet
  - Use survey sheets as a guide
- **Analyse information during or immediately following interview**

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Community

1. Meet with local authority
2. Explain project
3. Community Interview Form
   collect info about mining here
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Village or Mining Camp Data Form			
Location			
Name of Village/Camp		Latitude	
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Site Accessibility			
Access Route (Description)		River A	

Step-by-Step Approach
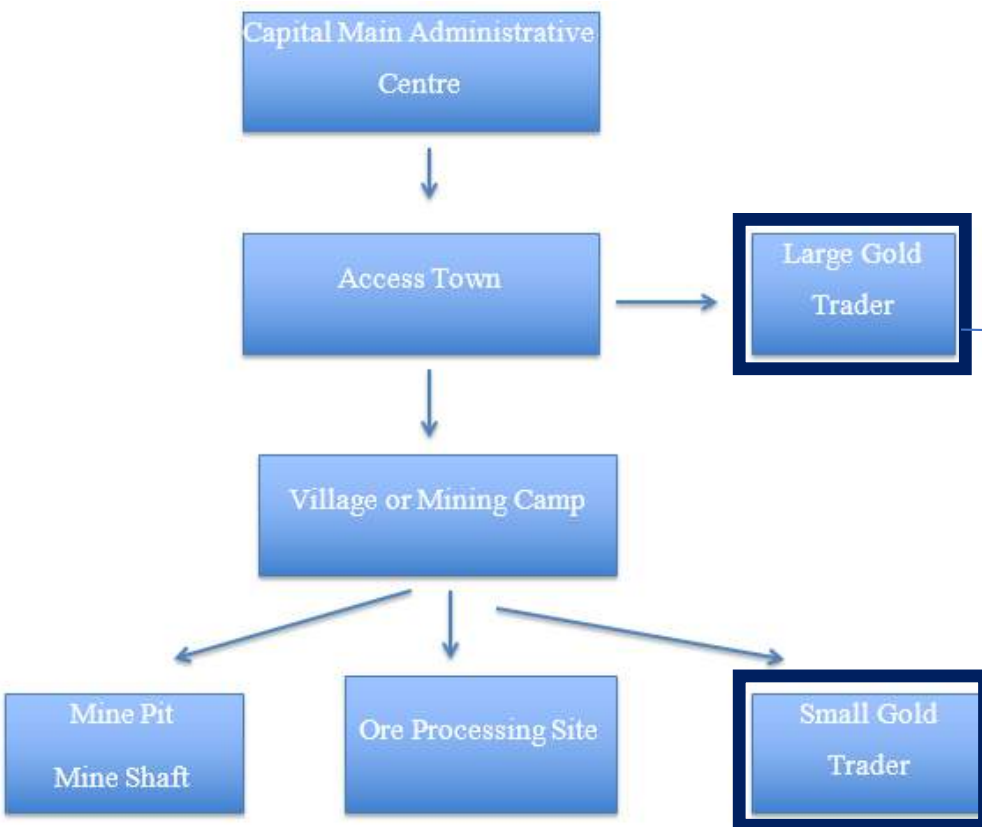
Gold Traders

1. Meet with head of gold house
2. Interview, referring to the Gold Trader Form
3. Start with questions about gold (price, amount purchased, types, grades)
4. Ask to see some gold. Check for Hg use. Take a photo.

Gold Buying/Trading House Data Form			
Location Information			
Name of gold trader:			
Tel		Date	
Email		Time	
Address			
City			

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Step-by-Step Approach

Extraction Site

1. Scan site and determine practical approaches. Begin to fill out ASGM General Observations
2. Go to a pit/shaft, identify self
3. Interview the pit/shaft boss and miners specific to the pit/shaft
4. Use ASGM Site Interview Form

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Step-by-Step Approach

Processing Site

1. Fill ASGM General Observations
2. Go to a processing team, identify self & explain project
3. Observe the processing workflow, noting steps, equipment & where Hg is used.
3. Go to each step & interview. Use ASGM Site Interview Form
4. Do detailed mercury measurement to find Hg:Au ratio
5. Use Hg:Au Form

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Ways of Collecting Information

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Interviews

with miners, processors, bosses, land owners, gold traders

Direct Observation

Type of mineral, mining/processing workflows, mercury use, site governance, socio-economic variables

Counts

Pits, shafts, processing systems, miners, bags of ore...

Weight

Bag of ore, mercury added/recovered, amalgam produced, gold produced...

Volume

Mercury added/recovered, water throughput...

GPS

Location, spatial distribution

Conducting Interviews

- Informal is better
- Build relationship and trust first
- Best to isolate one person for the interview
- **It`s a conversation**
- Ask questions first, take notes later
- Ask different questions to allow you to come to the same answers different ways
  - Evaluate answers as you go!
- Do NOT simply read questions off a sheet
  - Use survey sheets as a guide
- **Analyse information during or immediately following interview**

Analysing Data During Interview

Q. How much ore do you process in a day? A. 1 tonne
Q. How many bags of ore do you process in a day? A. 15
Q. How much does a bag of ore weigh? A. 100 kg

Analysing Data After Interview

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AGC

Processor #1:
- Throughput = 1 T/d
- Recovery = 60 g/T
- Days Active = 6 / wk
- Month Prod = ~250 g

Processor #2:
- Throughput = 10 bags/d
Measure: 100 kg/bag
Observe: 2.5 bag/6 hr
- Recovery = 1 g/bag
- Days Active = 25 / month
- Month Prod = ~200 g

Processor #1:
- Throughput = 1 T/d
- Recovery = **10-15 g/T**
  (*use 12.5 g/T*)
- Month Prod = ~250 g

Calculate Production:
- Daily = 60 g/d

- Month = 1440 g/month

?

Calculate Production:
- Throughput = 1 T/d
- Production = 10 g/d
- Month = 250 g/month

Calculate Production:
- Daily = 12.5 g/d
- Month = 300 g/month

!

Site Counts

- Visit sites and make counts of select characteristics
  - Active Pits
  - Active Processing systems
  - Workers per pit or system
  - Extraction per or throughput per system

Site Counts

For large sites or communities hire a local miner to show you around the site!

Counts at ALL sites in a region?
- *Couple with site authority interview?*
- *Triangulate with other regional information?*

Physical Measurements

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- Mercury measurements
- Gold Measurements
- Ore bag measurements
- Throughput

Hg:Au Ratio

Example: measuring the Hg:Au ratio for concentrate amalgam

1. Weigh the total amount of mercury before it is applied to the concentrated ore.

2. Weigh the excess mercury not forming a part of the amalgam.

3. If possible, weigh the amalgam formed after mixing the mercury with the concentrated ore, to better understand the loss of mercury to air versus water/soil.

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Example (continued)

4. Weigh the sponge gold remaining after burning.

5. If possible, weigh the gold doré after the sponge gold has been melted in order to understand the % of residual mercury remaining in the sponge (often 5%). This is valuable to know, because sponge gold is often burned in gold shops, located in populated areas.

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Data Analysis

Data Analysis

- Review and organize field data daily
- Assess data collected to ensure you have information needed for regional extrapolations
- Adjust field approaches as needed to ensure collection of useful data
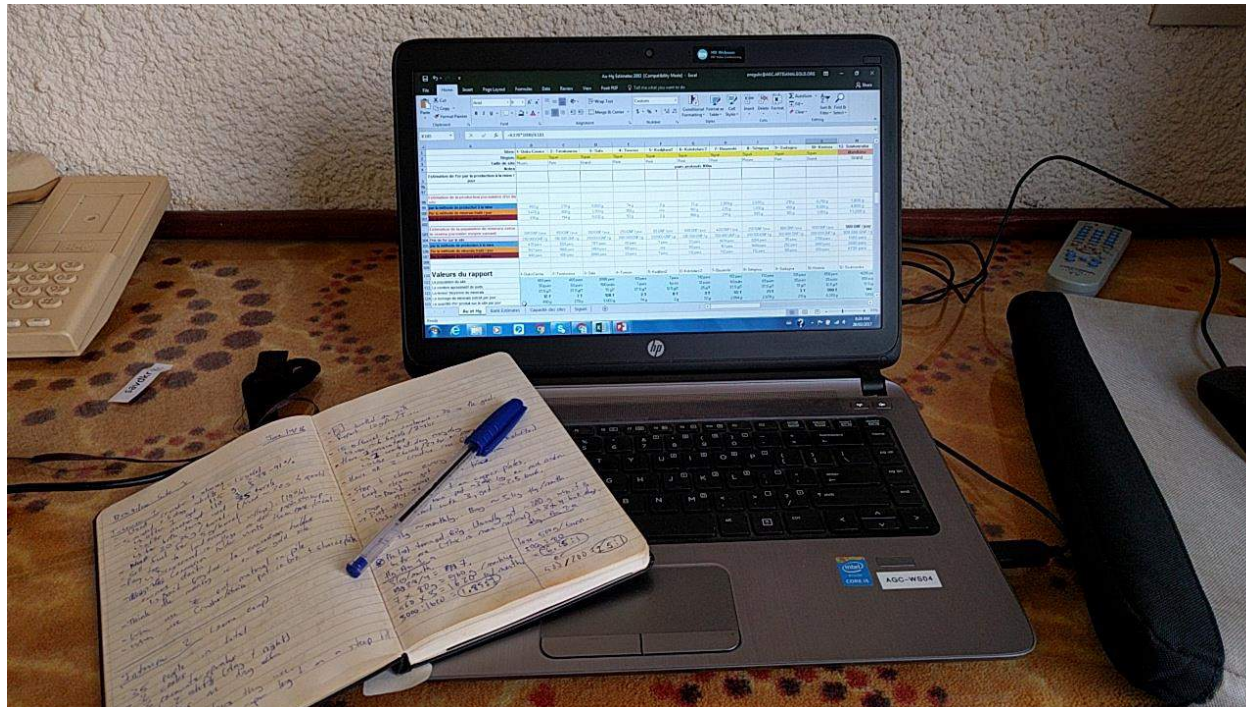
Data Analysis

- Must compile and organize data
- Determine which site data to use for regional estimates, and how to extrapolate
- Couple site data with existing information to compare, and produce regional and national estimates
- Compare estimates from different sources, and review to determine best estimates
- Use logic, triangulation, and gather extra information where needed
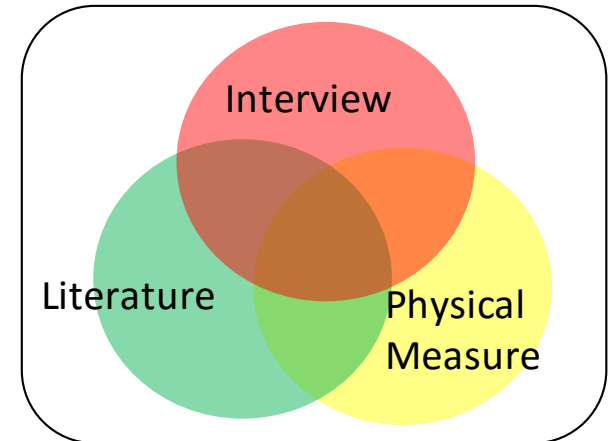
Excel Sheets: Unit Conversion

Quantity of Gold

informal unit for weight of gold	blade	
grams per informal unit for weight of gold	1.3	g/blade
weight of gold, in informal units (blade)	10	blades
weight of gold, in grams (g)	**13**	g

Purity of Gold

gold purity in karats	18	K
gold purity in %	**75%**	

Quantity of Ore

informal unit for weight of ore	sack	
kg per informal unit for weight of ore	60	kg/sack
tonnes informal unit for weight of ore	**0.06**	T/sack
weight of ore, in informal units (sack)	100	sacks
weight of ore, in tonnes (T)	**6**	T

Grade of Ore

informal unit for ore grade	g/sack	
unit for weight of gold	g	
grams per unit of gold weight (g)	1	g/g
unit for weight of ore	sack	
tonnes per unit of ore weight (sack)	0.06	T/sack
ore grade in informal units (g/sack)	2	g/sack
ore grade in ISO units (g/T)	**33.33**	g/T

Excel Sheets: Site Estimates

Enter location information

ASGM Site: Korfalo | Location Information

ASGM Site	Korfalo	Associted Communities	Kafala
Concession/Mining Title	-	County / District	Malika District
ASGM Mining Region	Godu	Province / State / Depertment	Godu Province
Lat	1.216667	Country	Goldaguay
Long	123.500000		
GPS device & datum	Trimble handheld GPS, NAD83		

Date(s) of data collection	Oct 30, 2017	Name of field researcher	Marie Cooke

Site contact(s): name	Ana Fleur	Eli Strong	Jim Jones
role	Community Chief	Mining Coordinator	Cooperative Leader
phone number	1(234)567-1234	1(234)567-8910	
email			jjones@email.com

Excel Sheets: Site Estimates

Enter data (e.g., extraction-based data)

ASGM Site: Placerton | Interviews with ASGM workers about Extraction								
Data Collection Form "ASGM Site Interview: Extraction"								

Extraction Unit Interviews - Extraction Type 1	Interview 1	Interview 2	Interview 3	Interview 4	Interview 5	Interview 6	Interview 7	Interview 8
Data entry								
interviewee type	EXTRACTION WORKER	EXTRACTION BOSS						
interviewee name	Eli	Jonas						
ore grade (g/T)	10	10						
gold purity (%)	70%	70%						
daily extraction per miner (T ore/shift)	0.1	0.1						
average active miners per unit	10	10						
number of units on site - total	20	20						
number of units on site - active	10	11						
shift length (hr)	8	8						
shifts per day	2	2						
days active per week (d/w)	6	6						
months active per year (m/y)	10	10						
days active per year (d/y)	200	200						
daily earnings per miner (g 24K Au)	0.5	0.5						
annual earning per miner (g 24K Au)	100	120						
price per g of **pure** gold (local currency/g 24K Au)	38	35						
price per g of **pure** gold ($USD/g 24K Au)	$38.00	$35.00						
Calculations of site-level information								
total miners on site (assumed = miners active/d)	200	220	---	---	---	---	---	---
daily ore extraction per unit (T ore/d/unit)	2	2	---	---	---	---	---	---
daily ore extraction on site (T ore/d/site)	20	22	---	---	---	---	---	---
yearly ore extraction on site (T ore/y/site)	4,000	4,400	---	---	---	---	---	---
yearly Au extracted on site - impure (kg Au/y/site)	40	44	---	---	---	---	---	---
yearly Au extracted on site - pure (kg Au/y/site)	28	31	---	---	---	---	---	---
value of yearly Au extracted on site (local currency/y/site)	1,064,000	1,078,000	---	---	---	---	---	---
value produced yearly per miner (local currency/y/miner)	5,320	4,900	---	---	---	---	---	---
value produced yearly per miner ($USD/y/miner)	$5,320	$4,900	---	---	---	---	---	---

Excel Sheets: Site Estimates

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Calculate - Useful variable averages:

	Site Interviews	
	Mean	Range
Extraction Type 1		
daily extraction per miner (T ore/shift)	**0.1**	0.1 - 0.1
average active miners per unit	**10**	10 - 10
shift length (hr)	**8**	8 - 8
shifts per day	**2**	2 - 2
days active per year (d/y)	**200**	200 - 200
daily earnings per miner (g 24K Au)	**0.5**	0.5 - 0.5
annual earning per miner (g 24K Au)	**110**	100 - 120
daily ore extraction per unit (T ore/d/unit)	**2.0**	2 - 2
value produced yearly per miner (local currency/y/miner)	**5,110**	4900 - 5320
Mineralogy		
ore grade (g/T)	6.0	2 - 10
gold purity (%)	80%	70 - 90%
Trade		
price per g of pure gold (local currency/g 24K Au)	38.00	38 - 38
price per kg of mercury (local currency/kg Hg)	---	0 - 0
purchased by miners per year, mercury, entire site (kg Hg/y)	---	0 - 0
purchased by sellers per year, mercury, entire site (kg Hg/y)	---	0 - 0

Excel Sheets: Site Estimates

Calculate - Baseline Estimates for the Site:

Site-Level Baseline Estimates for Placerton		Mean	Range
ASGM Ore Production (T 24-K Au/y)			
	Extraction-based	20,800	18000 – 23600
	Processing-based	20,940	19000 – 22880
	Transport-based	4,560	4000 – 5120
	average	15,433	
ASGM Gold Production (kg 24-K Au/y)			
	Extraction-based	59.3	53 – 65
	Processing-based	58.9	55 – 63
	Transport-based	31.9	28 – 36
	Trade-based (bought by gold traders)	25.6	25 – 26
	average	50.0	
ASGM Mercury Use (kg Hg/y)			
	Extraction-based	252	
	Processing-based	250	
	Trade-based (total sold by Hg sellers)	---	0 – 0
	Trade-based (total bought by miners)	---	0 – 0
	Transport-based	136	
	average	213	
Workforce			
	Extraction Workers (extraction-based)	430	400 – 460
	Processing Workers (processing-based)	408	400 – 416
	Transport Workers (transport-based)	30	28 – 32
	total	868	

These (variables (highlighted in yellow) go in the "Regoin Basline Calcs" tab of the Region Workbook.

Gold per Processing Type			
	kg	% of total	Hg:Au Ratio
Type 1	28.6	48%	6.87
Type 2	30.3	52%	1.79
Type 3	0	0%	0

Excel Sheets: Region Summary

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Summarize all useful variable averages in the region: (used later for extrapolation)

ASGM REGION: Goldu

Region name			Goldu								

Key Variable Statistics for ASGM Sites in Goldu

Variable	Site 1 Placerton		Site 2 [site name]		Site 3 [site name]		Site 4 [site name]		Site 5 [site name]	
	mean	range	mean	range	mean	range	mean	range	mean	range
Mineralogy										
ore grade (g/T)	9.0									
gold purity (%)	73%									
Trade										
price per g of pure gold (local currency/g 24K Au)	37.25									
price per kg of mercury (local currency/kg Hg)	---									
purchased by miners per year, mercury, entire site (kg Hg/y)	---									
purchased by sellers per year, mercury, entire site (kg Hg/y)	---									
Extraction Type 1										
daily extraction per miner (T ore/shift)	0.1	0.1 – 0.1								
average active miners per unit	10.000	10 – 10								
shift length (hr)	8	8 – 8								
shifts per day	2	2 – 2								
days active per year (d/y)	200.0	200 – 200								
daily earnings per miner (g 24K Au)	0.5	0.5 – 0.5								
annual earning per miner (g 24K Au)	110	100 – 120								
daily ore extraction per unit (T ore/d/unit)	2	2 – 2								
value produced yearly per miner (local currency/y/miner)	5110	4900 – 5320								
Extraction Type 2										
daily extraction per miner (T ore/shift)	0	0.35 – 0.4								
average active miners per unit	55	50 – 60								
shift length (hr)	8.00	8 – 8								
shifts per day	2.0	2 – 2								
days active per year (d/y)	200.0	200 – 200								
daily earnings per miner (g 24K Au)	1	0.5 – 0.5								
annual earning per miner (g 24K Au)	90.0	80 – 100								
daily ore extraction per unit (T ore/d/unit)	42	35 – 48								
value produced yearly per miner (local currency/y/miner)	4914.00	4788 – 5040								
Extraction Type 3										
daily extraction per miner (T ore/shift)	---	0 – 0								
average active miners per unit	---	0 – 0								
shift length (hr)	---	0 – 0								
shifts per day	---	0 – 0								
days active per year (d/y)	---	0 – 0								

Excel Sheets: Region

Calculate - Baseline Estimates for the Region

Approach 1
Visited all sites? Add estimates from all sites!

ASGM REGION: Goldu
Baseline Estimates for the Region

Approach 1: Collect site-specific data for ALL sites. Sum data for ALL sites in the region

Add data for all sites below (use data colelcted from site visits, plus additional info from stakeholders). Add together to get the regional baseline estimates.

Table 1. Summing the results of all regions	Site 1 Placerton	Site 2 [site name]	Site 3 [site name]	Site 4 [site name]	Site 5 [site name]	Site 6 [site name]	Site 7 [site name]	Site 8 [site name]	Si [site
ASGM Gold Production (kg/y)	50	60	45	34	43	43	18	90	
ASGM Mercury Use (kg/y)	213	300	225	170	215	215	90	450	
ASGM workforce	868	45	346	324	123	54	32	12	

Excel Sheets: Region

Calculate - Baseline Estimates for the Region

Approach 2
Visited a subset of sites? Extrapolate regional estimates using the variable averages and pieces of information about the region

Excel Sheets: Country

Calculate - Baseline Estimates for the country:

Sum the final estimates from all regions

[COUNTRY NAME]

Final Baseline Estimates of Mercury Use, Gold Production, and Workforce for the Country

Calculate baseline estimates for ALL regions. Sum data for ALL regions to obtain the national baseline estimates.

Add data for all regions below

	Region 1 [Region Name]	Region 2 [Region Name]	Region 3 [Region Name]	Region 4 [Region Name]	Region 5 [Region Name]	Region 6 [Region Name]	Region 7 [Region Name]	[Re
ASGM Gold Production (kg/y)								
ASGM Mercury Use (kg/y)								
ASGM workforce								

Step by Step Approach

1. Visit Regional Stakeholders
2. Visit Mining Communities
3. Meet Authorities
4. Visit extraction / processing sites
5. Casual introductions
6. Observations
7. Worker Interviews
8. Other local interviews?
9. Revise and compile data daily
10. Site and regional estimates
11. Adjust as necessary!

Conclusions

- Various approaches and tools to collecting data
  - Select those appropriate for your methodology
- Constantly analyse information received
  - Both in the field, and afterwards
- Adapt methodology and questioning as you go
- Triangulate as often as possible
- Most important tool is knowledge of ASGM and experience

Other Reference Documents

1. **Tools and Methods: Determining Mercury Use in the ASGM Sector**

2. UNEP Nap Guidance Document

    (http://www.unep.org/chemicalsandwaste/global-mercury-partnership/asgm/national-action-plans)

1. Minamata Convention on Mercury (UNEP)

2. Toolkit for Identification and Quantification of Mercury Releases (UNEP)

3. Developing Baseline Estimates of Mercury in ASGM Communities (AGC)

4. A Practical Guide: Reducing Mercury Use in ASGM (AGC/UNEP/UNIDO)
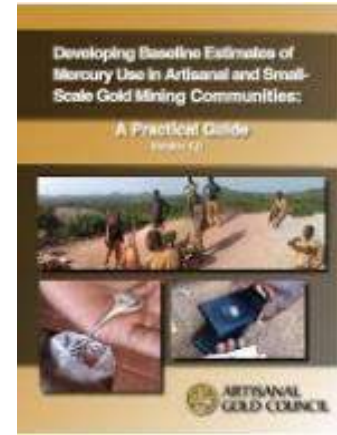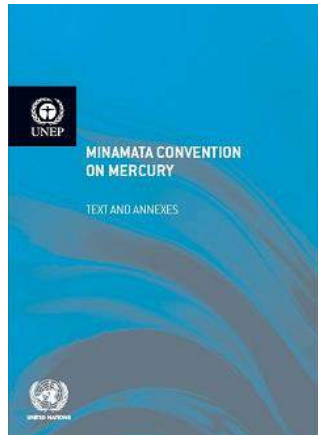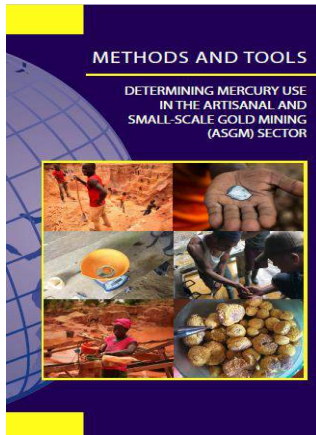
Thank you very much!

Questions?

Extra slides

9.1.1. Gold Calculations

Correcting Impure Gold to 24K or 100% Pure Equivalence

$$mass\ pure\ gold = (mass\ impure\ gold) \times \frac{(purity\ of\ impure\ gold)}{(purity\ of\ pure\ gold)}$$

If the purity of your gold is stated in karats, the calculation will look like:

$$(mass\ impure\ gold) \times \frac{(karatage\ impure\ gold)}{24}$$

If the purity of your gold is stated as percentage, the calculation will look like:

$$(mass\ impure\ gold) \times \frac{(\%\ purity\ of\ impure\ gold)}{100}$$

e.g.1. 50 g of 18K gold = (50 g) x (18/24) = 37.5 g of 24K gold

e.g.2. 70 g of 80% pure gold = (70 g) x (80/100) = 56 g of 100% pure gold

Gold Yield from Ore (Gold Production)

$$gold\ yield = (mass\ ore) \times (recoverable\ ore\ grade)$$

e.g. 1. How much gold is yielded from 30 T of ore that has a recoverable grade of 5 g/T?

gold yield = 30 T x 5 g/T = 150 g of gold

e.g. 2. The average bag extracted by miners on site weighs 10 T. The recoverable ore grade is 6 g/T. How much gold is in each bag?

gold yield per bag = 10 T/bag x 6 g/T = 60 g of gold per bag

9.1.2. Mercury Calculations

Mercury recovery
Mercury-to-gold (Hg:Au) Ratio
See *Section 6: Mercury-to-Gold (Hg:Au) Ratios.*

9.1.3. Throughput Calculations

Sluice Throughput

$$throughput\ rate = (width) \times (water\ depth) \times (water\ velocity)$$

$$daily\ slurry\ throughput = (throughput\ rate) \times (hrs\ operating)$$

$$daily\ ore\ throughput = (daily\ slurry\ throughput) \times$$
$$(mass\ of\ sediment\ per\ m3\ of\ slurry)$$

e.g.

Field officers measure the dimensions of a sluice and the velocity of the ore slurry passing through it. They interview the processors to find out how many hours per day the sluice is operating. They also fill a 1L soda bottle with the slurry enter the sluice and weigh it. They then drain the water out of the 1L bottle of slurry and weigh the sediment. They find:

Sluice length = 14 m

Sluice width = 0.8 m

Water depth = 0.01 m

Water velocity = ~1.25 m/s

Hours operating = 20 hr/d

1 L slurry = 1285 g

Mass of sediment in 1L of slurry = 0.463 kg

What is the daily ore throughput of the sluice?

Throughput rate = 0.8 m x 0.01 m x 1.25 m/s = 0.01 m³/s

Daily slurry throughput = 20 hr/d x 3600 s/hr x 0.01 m³/s = 720m³/d

Daily ore throughput = 720 m³/d x 463 kg/m³ = 333360 kg/d = 333 T/d

Calculations per Each Processing System:

* important: each of these calculations is for one specific processing system type. Calculate this information for each system type (e.g., system 1 = sluice, system 2 = rastra, system 3 = panning).

Daily 24K gold production (g/R/d)
Daily throughput (T/sys/d) x ore grade (g/T)

Correct karatage to 24K (as in Section 9.1.1.)

Daily mercury loss (g/R/d)
System-specific daily 24K-Au production (g/sys/d) x system Hg:Au ratio

Daily number of active processors (px/sys/d)
Shift count (px/shift) ÷ shift length (hrs/shift) x 24hrs

Daily active miners required to produce the daily throughput (ex/sys/d)
Daily throughput (T/sys/d) ÷ miner ore prod (T/ex/d)

Calculations for Site-level Daily Information

* once calculations are made for each type of processing system on the site, the averages for each processing system can be combined into site-level information.

Daily 24K gold production (g/site/d)
Average of system type 1 daily 24K gold prod (g/sys1/d) x #sys1/site

Also calculate for system type 2, type 3, etc. and then sum production values for all system types.

Daily mercury loss (g/site/d)
Average of system type 1 daily Hg loss (g/sys1/d) x #sys1/site

Also calculate for system type 2, type 3, etc. and then sum production values for all system types.

Daily number of active processors (px/site/d)
Average system 1 daily number of active processors (px/sys1/d) x #sys1/site

Also calculate for system type 2, type 3, etc. and then sum production values for all system types.

Daily number of active miners (ex/site/d) – Option 1
Average system 1 daily active extractors (ex/sys1/d) x #sys1/site

Also calculate for system type 2, type 3, etc. and then sum production values for all system types.

Daily number of active miners (ex/site/d) – Option 2
Average site-level daily throughput (T/site/d) ÷ average miner ore production rate (T/ex/d)

Calculations for Regional-level Daily Information

Daily 24K gold production (g/region/d),
Daily number of active processors per region (px/region/d), and
Daily number of active miners per region (ex/region/d).
Extrapolation from site-level data using a known piece of regional information, e.g., number of processing systems in the region. *(see Section 7.2: Extrapolating Regional Estimates).*

Daily mercury loss (g/reg/d)
Daily 24K gold production (g/sys1/d) x (% of production yielded by system type 1) x (Hg:Au Ratio for system type 1)

Also calculate for system type 2, type 3, etc. and then sum production values for all system types.

Calculations for Regional-level Annual Information

Annual 24K gold production (g/site/yr)
Daily 24K gold production (g/region/d) x active days per year (d/yr)
Convert to kg/region/yr by dividing by 1000.

Annual mercury loss (g/site/yr), Option 1
Daily Hg loss (g/region/d) x active days per year (d/yr)
Convert to kg/region/yr by dividing by 1000.

Annual Hg loss (kg/site/yr), Option 2
Annual 24K gold production (kg/region/yr) x (% of production yielded by system type 1) x (Hg:Au Ratio for system type 1)

Also calculate for system type 2, type 3, etc. and then sum production values for all system types.

Annual number of active processors (px/region/yr)
assumed equal to the daily statistic

Annual number of active miners (ex/region/yr)
assumed equal to the daily statistic

Calculations for National-level Annual Information

Annual 24K gold production (kg/country/yr)
Sum all 24K gold production (kg/region/yr) for each of the major ASGM mining regions in the country

Annual mercury loss (kg/country/yr)
Sum all Hg loss (kg/region/yr) for each of the major ASGM mining regions in the country

Number of active processors (px/country)
assumed equal to the daily statistic

National active extractors (ex/country)
assumed equal to the daily statistic