

# ENVIRONMENTAL ASSESSMENT GUIDELINES AND IMPLEMENTATION TOOLKIT FOR ARTISANAL AND SMALL SCALE MINERS (ASM)

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# FOREWORD

The Environmental Assessment Guidelines and Implementation Toolkit has been designed as a simplified technical guide for use, primarily by Artisanal and Small-scale miners (ASM), field staff and managers, implementing partners, relevant government authorities, specialist consultants and individuals working on environment-related support projects or programmes related to ASM activities. It should be noted that these assessment guidelines do not substitute for a formal Environmental Impact Assessment, which is an international standard required by the host government. The guidelines aim to promote the use of assessment, monitoring and evaluation in the ASM sector with regards to environmental issues to ensure a sound environmental management before, during and after mining with little requirement for technical expertise. The toolkit comprises a series of checklists and guideline tools, each addressing several environmental management issues.

The step-by-step toolkit is divided into five (5) parts:

- (1.) Checklist Guidelines on Environmental Baseline Assessment-aimed at documenting the current status of natural resources of the site. During this the developer needs to ask locals as many questions as possible to get an understanding of the area's natural environment and history.
- (2.) **Checklist Guidelines on Environmental Risk Assessment**-aimed at documenting the sites major environmental risks. Once the risks are identified, the best continuous management practices can then be applied.
- (3.) **Environmental Management Guidelines**-aimed at helping ASM to manage their identified environmental risks and impacts
- (4.) **Checklist Guidelines on Environmental Inspections**-for continuous environmental monitoring, identification of any problems on-site and action planning.
- (5.) **Guidelines on Filing and Documentation Requirements**-aimed at good documentation of the site environmental issues

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# 1 INTRODUCTION

To ensure that mining meets the social and economic returns sustainably, good environmental management is essential. Past experiences and lessons have shown that there are many benefits of good environmental management in mining operations that can ensure that the local community gains from any interventions from good natural resources management. Thus, this environmental management guidelines and implementation toolkit is intended to help ASM plan and manage the environmental conditions of a particular operation before, during and after mine closure. The overall purpose is to identify any potential environmental risks and apply right management practices. Overall, the guidelines and implementation toolkit are designed to help users:

- Gather important information on the state of the site natural resources (environmental baseline) information
- Identify environmental risks for the ASM operations
- Use the best practices to manage environmental risks
- Ensure that the mine site is continuously inspected to check the environmental problems and solve them
- Keep a record of the site environmental issues

# 1.1 HOW TO USE THESE GUIDELINES AND IMPLEMENTATION TOOLKIT

- The toolkit is divided into five (5) parts comprising checklists and guidelines.
- Note that when using these guidelines, users should only follow what is applicable to them. This is because the size of mining is different, for example what might apply to a big small scale mining operation which uses heavy duty machinery might not apply to an artisanal miner involved in manual crushing of stones
- The five different, but related parts of the toolkit and their intended outcomes are presented in **Table 1**.

Toolkit Component	Expected outcome	Expected Documentation
Part 1: Baseline Environmental Assessment Guidelines	To understand the site mining methods and the current state of natural resources present on site	Checklist of baseline environmental assessment
Part 2: Environmental Risk Assessment Guidelines	To identify environmental risks at the mine site	Checklist site environmental risk register
Part 3: Environmental Management Guidelines	To provide guidelines on how to manage the environment	Site environmental management plan
Part 4: Environmental Inspections	To check if the miners are complying to the environmental management guidelines	Environmental monitoring checklist

 Table 1: Toolkit components, expected outcome and documentation

To ensure an easy access of information on the environment for the site

Environmental Management File

# 2 PART 1: BASELINE ENVIRONMENTAL ASSESSMENT GUIDELINES

# What is baseline environmental assessment and why is it important?

- Baseline environmental assessment provides information on the current state of the site natural resources (water, animals, plants etc) as found by the intended miner ( see Figure 1).
- It is important because it helps the miner gather information on the current state of natural resources of the site and acts as a reference against future changes in the environment so that one can tell whether environment has been damaged or remained the same.



Figure 1. Natural environment showing natural features for documentation in baseline assessment

# 2.1 INSTRUCTIONS

- Gather a team of three people or more, preferably a representative from the local community, local government authority and one from a local non-governmental organization
- Conduct the baseline environmental assessment by filling in **checklist 1** below:

- Discuss with local communities as ypu gather information on natural resources (important trees, rivers, animals etc) so as to understand the values placed on different natural resources.
- File and Keep a record of your Baseline Environmental Assessment for future reference

#### Checklist 1: Baseline Environmental Assessment

Г

Date:
Site Name:
Team Members and Titles:
A. MINING METHODS
1. Describe the types of equipment to be used in mining? (e.g. shovel, pick-ax, hoes), machinery (e.g. hydraulic machine, pump, backhoe excavator), and other devices (e.g. dynamite)
2. List and name any chemicals to bed used in mining or processing of minerals or servicing of vehicles (e.g mercury):
3. State if <b>diesel</b> or <b>petrol</b> will be used and stored on site?
4. State if accommodation will be provided on site?
B. LAND COVER AND PLANT ASSESSMENT
1. State the area size (e.g. 30Ha) and former land use (e.g. Was it a Forest reserve, agriculture land, hunting, firewood collection etc):
2. List dominant tree types and shrubs (Including local names) :
3. List common grass types:

# C. WILDLIFE/ANIMAL ASSESSMENT

1. List original wildlife/Animals in the area (snakes, wild animals etc):

2. Do people hunt in the mining area or nearby? If yes, what animals do they hunt for food?

3. Are there any animals that were frequently hunted/caught in the past but are now difficult to find or even locally extinct? If **yes**, name them

# D. WATER RESOURCES ASSESSMENT

Surface and Underground Water Resources

1. Name and describe any surface water bodies within the mining area and surrounding area/community (e.g. any rivers, streams and where they start and end from and benefit to communities e.g. drinking water, irrigation)

List of rivers:

Benefit and uses by local communities:

2. Name and state any underground water bodies within the mining area and surrounding area/community (e.g. number of boreholes both functional and non-functional)

3. Describe how water is used as you are mining (e.g. stone washing, stone washing, dust control etc.)?

4. What happens to the water after it has been used (e.g. Is it discharged in streams or left in pits)?

5. List physical observations of water quality?: Color (e.g. cloudy, greenish) : Turbidity (Silted or not) : Flow (is the river flowing? Yes or No):

6. Are there any reported health effects of water contamination from community, If yes name them **e.g. diarrhoea, skin rashes, etc.** 

Fish and other aquatic (Water) Animals

1. List original animals found in water. Include **fish species** as well as other aquatic animals such as **water turtles**, **frogs**, **crocodiles**, **monitor lizards** and other reptiles if available.

2. State if there is presence of keeping (breeding) of water (aquatic) animals, **e.g. fish farms, Crocodile farms around the communities**.

3. List the water (aquatic) animal types that local people catch in the mining area and its nearby areas.

4. State if there has been reduced presence of water (aquatic) animals **e.g. fish due to overfishing** 

# E. AIR QUALITY ASSESSMENT

1. Does the mining method affect air quality in and outside the mines? if yes, Briefly explain how (e.g dust is produce, exhaust from vehicles, fumes from mercury burned in open air).

2. Are there areas where **blasting**, **crushing**, **panning** takes place? if yes, list those areas of your mine.

3. Any reported and observed health effects due to air pollution? If yes, explan **e.g. silicosis, asthma, and mercury intoxication.** 

### F. NOISE ASSESSMENT

Does the mining process include activities that cause excessive noise? If yes, explain (e.g. blasting or the use of compressed air hammers or hydraulic mining machines?)

# 3 PART 2: ENVIRONMENTAL RISK ASSESSMENT GUIDELINES

### What is an environmental risk assessment and why conduct one?

- An environmental risk assessment is a process of identifying the likely environmental risks and impacts of your mining activities.
- It helps you identify the most important environmental risks and to come up with an environmental risk register for your site that requires management attention

# 3.1 INSTRUCTIONS

- Use Cheklist 2 below. Tick (✓) your mining project activities to identify the environmental risks and impacts that come with them. Once this is completed, it becomes your environmental risk register
- File and Keep a record of your risk register in the environmental folder
- **Note:** New risks identified should be added to the register as the mine site operation changes, expands or whenever any new risks are identified by the miner

Checklist 2: G	Guidelines on	potential	environmental	risks and	impacts	from ASM

Activity	Tick where applicable (√)	Risks	Impacts
Clearance of vegetation before mining		Deforestation and	<ul> <li>Land degradation</li> <li>biodiversity loss-animals, trees</li> </ul>
Clearance of vegetation for construction of mine infrastructure		100 301 1033	<ul> <li>Loss of non-wood forest products such as animal and plant food (e.g mushrooms) on which communities rely</li> </ul>
Clearance of vegetation for			<ul> <li>Persistent erosion and Land degradation</li> </ul>
dumping of waste rock.domestic waste			<ul> <li>Siltation in nearby streams/rivers thereby compromising the water quality and biodiversity</li> </ul>
Dumping of waste		Dust and silt release from open waste rock dumps/Water Pollution due to silt runoff	Erosion/siltation of     surface water bodies
rock/overburden			Heavy metals     contamination
			Dust fumes

Mine pits	Onen nite sefety	
	hazard/Landslides	<ul> <li>Stagnant water can be a breeding ground for mosquitoes</li> </ul>
		<ul> <li>Pits can be a drowning hazard</li> </ul>
		Human life loss
Mine pit water     during mining	Poor Pit water	Water siltation
	management/water pollution	Water pollution
Panning and ore     washing using     water from the	Water pollution- Silt accumulation	<ul> <li>Poor water quality as a result of silt</li> </ul>
streams	in rivers	<ul> <li>Lack of water for drinking</li> </ul>
	Loss of river bodies	for both humans and animals
Chemical use for processing. E.g.	Human health hazards	Loss of plants and animals
Mercury, Cyanide	Soil and water	<ul> <li>Poor water quality</li> </ul>
	pollution	• Mercury can be inhaled and cause damage to the kidneys, digestive system and immune system
Chemical storage	-	<ul> <li>Soil and water contamination</li> </ul>
Vehicle     servicing/repair on     site	Oils and Chemical Spills	<ul> <li>Makes revegetation difficult</li> </ul>
Machinery		<ul> <li>Kills soil vital microorganisms</li> </ul>
servicing/repair on site		<ul> <li>Heavy metal pollution to crops/plants/water</li> </ul>
Hydrocarbons     (Oils) use and     storage		sources (surface and underground)
Panning of stones		Carbon dioxide from vehicles contributes to climate change
Crushing of stones		Dust-inhalation of silicate
Digging	Air pollution	particles cause silicosis, a lung disease
Land excavations		

<ul> <li>Any burning activities e.g. Incineration, waste burning</li> <li>Heavy machinery use</li> </ul>			
on site			
<ul> <li>blasting,</li> </ul>			
On-site housing		Waste generation/Poor sanitation	<ul> <li>Pollution from waste disposal</li> <li>Water related diseases e.g diarrhea</li> </ul>
Any oth	ner new Mining	activities and Enviror	nmental Risks
Activity		Risks	Impacts

# 4 PART 3: ENVIRONMENTAL MANAGEMENT GUIDELINES

- Environmental management guidelines are meant to show how you are going to manage your identified environmental risks in part 2
- Please use the illustrations in 4.1 below and the summary table in **Table 2** as guidelines for best environmental management practices

# 4.1 ILLUSTRATIONS ON BEST ENVIRONMENTAL MANAGEMENT PRACTICES

### (1.) Top soil loss Management and Deforestation



- Always plan your mine closure before mining (Pit development, waste rock dump site) begins
- Remove 30 cm or more of the topsoil and store it where it won't be lost
- The topsoil is a valuable source of grass and plant seeds
- The top soil is to be used as a final cover for waste rock dumps and shallow pits rehabilitation to aid in revegetation of the mined land as will be shown below
- Minimize cutting of trees, only clear areas where the actual mining is taking place

#### 2) Waste Rock Dump Rehabilitation



- Apply the stockpiled topsoil as shown to allow easy revegetation
- Spread the top soil with local grass and plant trees across the slope when available
- Build toe drains around the dump to allow for good water draining system

### (3.) Mine Pit Rehabilitation



# (a) Dip pit rehabilitation

- Provide proper signage to pit access area: e.g. Danger: Open pit ahead, Entry prohibited
- Allow pits to flood with water
- Check the water quality and use it for fish keeping. Old quarry pits usually have good water quality for this

### (b) Shallow pit rehabilitation

- Fill up the pit with any waste rock/materials available at the bottom.
- Apply a final thin layer of top soil which was stockpiled earlier on
- Spray grass seeds from surrounding environment and plant local plant trees when available

# (4.) Mine Pit Water Management



- Pumped water from the pits contains silt and may contain acidic water
- Pump the water out with a created temporary drainage with sumps/silt traps as shown above to help the silt settle down and only allow cleaned water out to the environment

### (5.) Water Pollution Management



# (a) DO:

- Keep any development at least (≥100 m) away from the river basin
- Avoid deforestation and land clearance along the water bodies especially rivers and streams

#### **Advantages**

- Prevents siltation of river bodies
- Keeps the stream flowing, maintains good water quality for drinking and other domestic uses



# (b) Don't:

 Clear vegetation and practice agriculture practices less than 100m from river banks

### Risks

- Leaves the land bare and prone to erosion and streams siltation. This results to eventual loss of the stream
- Risks of nutrient overload in the water body resulting to eutrophication and loss of the river quality and flow

### (6.) Oils Management





# (a) Machinery Servicing

- Servicing of machinery should be done on paved surfaces
- If not available always service using an improvised cover such as tents
- Drain the oils in drip trays when available or used cut oil drums and safely store them in empty oil drums

#### (b) Oil/Hazardous Materials Storage

- Always store oils/chemicals/hazardous materials on bunded structures-You can use concrete bunds
- The storage drums should be well labelled: Name of the oil/chemical, date stored and the nature of the material
- Ensure the storage area is well ventilated and has appropriate fire extinguisher
- The storage area should also have adsorbents such as sawdust and lime in case of any spillage
- Recycle the used oil for use by local communities such as in brick making or sell back to the producer/sellers

### **Continuation-Oil Management**

### Management of used Oil Rags/Oil Filters/ and Used spill kits such as sawdust

- Store the used oil rags/sawdust and well drained oil filters in a separate bin
- Take them to a local incinerator when available or
- Buy a simple portable waste incinerator for use on site as shown below
- Once burnt the oil filters metals can be reused as waste metal

# (c) Managing your used oil, sawdust and oil filters





#### (7.) Occupational Health and Safety and Air Pollution Management

#### **Workplace Safety**

(a) A woman at risk of safety hazards-no dust mask, no safety boots and with exposed arms and legs while panning silica stones (b) A woman in correct protective clothing

- Always wear appropriate personal protective equipment (PPE) applicable to your operations as shown above
- Artisanal working in dust prone areas are encouraged to use dust musts by improvising even making them from worn out clothes
- If not working at night or traffic prone areas, artisanal are encouraged to put on long trousers and long sleeved shirts to cover their bodies
- Safety boots are a must for all ASM
- · Hard hat is a must for areas prone to falling objects or coming into impacts with other objects

# Continuation- Occupational health and safety and Air Pollution Management



# **Dust Suppression**

• Suppress dust to prevent inhalation of dust/silica particles using (a) water sprinklers or (b) portable water bowser or any other improvised means to help suppress dust

# **Table 2:** Summary Environmental Management Guidellines

Activity	Risks	Impacts	Management Guidelines
<ul> <li>Clearance of vegetation before mining</li> <li>Clearance of vegetation for construction of mine infrastructure</li> <li>Clearance of vegetation for dumping of waste rock, domestic waste</li> </ul>	Deforestation and Top soil loss	<ul> <li>Land degradation including</li> <li>biodiversity loss- animals, trees</li> <li>Loss of non-wood forest products such as animal and plant food on which communities rely</li> <li>No land rehabilitation</li> <li>Persistent erosion and Land degradation</li> <li>Siltation in nearby streams/rivers thereby compromising the water quality and</li> </ul>	<ul> <li>Minimize cutting of trees, only clear areas where the actual mineral resource is.</li> <li>Revegetate land. Plant back trees, both within the mine site and around the community.</li> </ul>
<ul> <li>Dumping of waste rock/overburde n</li> <li>Mine pits</li> </ul>	Non Rehabilitation of waste rock dumps/Water Pollution Open pits safety hazard/Landsli des and non- rehabilitation	<ul> <li>biodiversity</li> <li>Erosion/siltation of surface water bodies</li> <li>Heavy metals contamination</li> <li>Dust fumes</li> <li>Stagnant water can be a breeding ground for mosquitoes</li> <li>Bits can be a</li> </ul>	<ul> <li>Dip pits should be flooded with water with proper signage put in place e.g. flooded pit ahead-No unauthorized entry</li> <li>Shallow pits should be buried with waste rock materials with a final topsoil layer</li> <li>waste rock dump faces should be covered with top soil and reversetated</li> </ul>
		Pits can be a     drowning hazard	<ul> <li>Promote proper pit construction and benching</li> </ul>
Mine pit water during mining	Pit water management- Siltation of water bodies/polluti on	<ul><li>Water siltation</li><li>Water pollution</li></ul>	<ul> <li>Dewater the pit water on constructed water drainages that allow silt to be settled (Silt traps)</li> </ul>

Panning and ore washing using water from the streams	Water pollution-Silt accumulation in rivers Loss of river bodies	<ul> <li>Poor water quality as a result of silt</li> <li>Lack of water for drinking for both humans and animals</li> </ul>	Ensure panning and washing of ores takes place downstream from where water consumption for food, irrigation, livestock takes place
Chemical use for processing. E.g. Mercury, Cyanide	Human health hazards Soil and water pollution	<ul> <li>Loss of plants and animals</li> <li>Poor water quality</li> <li>Mercury can be inhaled and cause damage to the kidneys, digestive system and immune system</li> </ul>	Stop the use of mercury and use alternative processes
<ul> <li>Chemical storage and use</li> <li>Vehicle servicing/repai r on site</li> <li>Hydrocarbons (Oils) use and storage</li> <li>Machinery servicing/repai r on site</li> </ul>	Oils and Chemical Spills	<ul> <li>Soil and water contamination</li> <li>Makes revegetation difficult</li> <li>Kills soil vital microorganisms</li> <li>Heavy metal pollution to crops/plants/water sources-surface and underground</li> </ul>	<ul> <li>Always store oils/chemicals/hazardous materials on bunded structures-You can use concrete bunds</li> <li>The storage drums should be well labelled: Name of the oil/chemical, date stored and the nature of the material (E.g. Flammable, Toxic)</li> <li>Ensure the storage area is well ventilated and has appropriate fire extinguisher</li> <li>The storage area should also have adsorbents such as sawdust and lime in case of any spillage</li> <li>Recycle the used oil by selling/giving to local communities for use in activities such as brick making or sell back to the producer/sellers</li> </ul>

					•	Ensure machinery repair/vehicle serving does not result to spilling of hydrocarbons on the soil by draining the oil in cut used drums or using a tent or tarpaulin when available to reduce oil spillage to the ground.
<ul> <li>Panning stones</li> </ul>	) of		•	Carbon dioxide from vehicles contributes to	•	Use the righ personal protective equipment (PPE).
Crushing stones	g of	Air pollution	•	Dust-inhalation of silicate particles	•	Use a dust mask when conducting activities in dust prone areas. If one
Digging/ develop	/Pit ment			cause silicosis, a lung disease		can't afford to buy, improvise such as using wet dust mask made
<ul> <li>Land</li> <li>Excavat</li> </ul>	ions				•	from used cloth material Apply dust suppression,
<ul> <li>Any burn activities Incinera waste burn</li> </ul>	ning s e.g. tion, urning					Quarry ore stones prior to crushing
Heavy     machine	ery use					
Light ve     use on s	hicles site					
<ul> <li>blasting</li> </ul>	,					
On-site     housing		Waste generation	•	Water/Soil Pollution from waste disposal	•	Provide separate bins for domestic and industrial waste
			•	Poor sanitation	•	Build toilets/bathing rooms and borehole on site for adequate water provision

# 5 PART 4: ENVIRONMENTAL INSPECTIONS

#### Why inspect your environment?

- Helps you understand if you are managing the environment well
- Help you identify environmental problems being faced on your mine site

### How should it be done?

- Appoint an environmental, health and Safety team leader within the organization to act as a leader for this process.
- It is also important that management occasionally participates in this process

# 5.1 INSTRUCTIONS

- Conduct the monitoring at least once a week to assess the site environmental condition using **checklist 3** below
- File the inspection checklist for your records and follow up on the actions until they are all completed

Date :	Inspected by :	Observed by :		
Site Name:	Position :	Position :		
Workers Safety				
Observation	Comments	Required Action		
Are workers wearing appropriate PPE ( <b>Safety</b> <b>boots, reflective clothing,</b> <b>dust mask, hard hut)</b> for the job been done?				
Waste Management and Sanitation				
Observation	Yes/No-Comments	Required Action		
Are bins available and in appropriate location for				
nandling and easy access?				
Are bins regularly emptied?				
Are bins regularly emptied? Any signs of litter around the site?				

Checklist 3: Checklist on Environmental Inspection

Hydrocarbons Management				
Observation	Yes/No-Comments	Required Action		
Is the hydrocarbon (oils) storage area clearly marked?				
Are oil drums well labelled?				
Are there signs of oil/diesel/chemical stains on ground and surrounding areas?				
Is the oil drum storage area with enough fire extinguishers?				
Are oil drums on bunded area?				
Waste Rock Dump/Overburden Management				
Observation	Yes/No-Comments	Required Action		
Does the waste rock dump area have clear entrance signage?				
Is there a minimum of 1.8m windrow around accessible dump edges?				
Are there surface ponding at the dump floor that may cause instability?				
Are there tension crucks on the dump floor?				
Are there tension crucks on dump faces?				
Are toe drains and silt trap present and adequate?				
Pit Condition				
Observation	Yes/No-Comments	Required Action		
Does the pit entrance have clear signage labelled/marked?				
Are the pit walls stable?				

Is benching being done to prevent high walls?	
Is there water ponding, if so, how is the water being managed?	

# 6 PART 5: DOCUMENTATION REQUIREMENTS AND MANAGEMENT REVIEW

# 6.1 FILING AND DOCUMENTATION REQUIREMENTS

#### Why keep a file for your site environmental management?

- Provides easy access to the site environmental information
- Provides evidence for the site compliance to environmental requirements
- Provides evidence of management commitment to environmental management and compliance
- Ensure your file meets at least the following documentation requirements:

#### **Filing Requirements**

- A: Company Environmental Policy
- B: Site roles and Responsibilities
- C: Environmental Risk Register
- D: Mine Licences and Permits
- E: Communications (Toolbox talks, Letters from ZEMA etc, Management review meetings)
- F: Meeting Minutes and Attendance Registers for Environmental trainings
- G: Inspections Reports

H: Incidents (environment, health, safet-inuries, deathsy) reports and Investigations on site

# 6.2 MANAGEMENT REVIEW

Management should continuously review (preferably once in three to six months) the environmental performance of the site and include environmental management in all their planning **(Figure 2)** to:

- Priotise environmental management issues of concern
- Hear from workers concerns
- Identify if there any new environmental risks requiring attention
- Ensure management of the environment is a continuous process





