3. PREPARING THE ASSESSMENT AND FIELD VISIT

3.1 General Aspects

This section describes:

- In-office preparation of the assessment by the Assessor before visiting the site.
- Field inspection visit by the Assessor to collect all information required according to Handbook procedures.

To properly prepare the risk assessment of a SD/AMS, the Assessor must collect and analyze as much information as possible to ensure he/she builds a comprehensive picture of the situation at the site.

It is important that the preparatory stage of the assessment be tailored to the level of complexity of the SD/AMS under study; in other words, sites in remote areas with few installations and no hazardous material deposits will not require as much documentation as sites with more mine works, hazardous waste and/or tailings deposits, especially if they are located near populated areas, environmentally sensitive areas or productive zones. In those cases more detailed information will be required because there will be more components involved in defining safety and/or environmental risks.

Once the preparatory stage in the office is complete, the Assessor will conduct the field inspection to collect all information required to assess the site risks.

One important tool that the Assessor will use in this process is the **Risk Assessment Record Form (RARF),** which is meant to assist the Assessor in applying the procedures outlined in this Handbook step by step, create a log of the process and collect information from the site (Annex E). This instrument is available in hard copy and digital format (Excel file). Additional information on using the RARF can be found in Annex E.

3.2 Stages in Preparing the Assessment

The stages that the Assessor should follow in preparing the risk assessment are as follows:

1. Information gathering
2. Map preparation
3. Definition of the Area of Study
4. Description of Receptors in the Area of Study

5. Summary of Assessment Preparation

6. Preparation for site visit

3.2.1. Information Gathering

The first stage involves gathering all pertinent information related to the site. This task should begin with a review of the file that was prepared by GSN and contained in the Mine Inventory Data Sheet (MIDS) (Annex G). This information includes:

- Form for the site.
- Inventory of documents and copies.
- Sketch of the location, plans, images and photographs.
- Record of samples, laboratory certificates and analytical reports.

The Assessor's first job is to carefully review all of the above information in order to become familiar with the information contained therein, namely:

- Identification of the site (coordinates, location name, etc.).
- Last known owner/rights holder.
- Type of primary and secondary minerals extracted and process used.
- Regional and site geology.
- Existence of maps to scale, with the site location indicated.
- Size, location and description of the works and installations present at the site.
- Presence of hazardous waste.
- Environmental setting:
    - Climate;
    - Hydrology and water use;
    - Geohydrology;
    - Physiography;
    - Social issues; and
    - Land use.

The list above should be considered a basic checklist that the Assessor can work through point by point to ensure that the necessary information has been collected. This list will also reveal any gaps that need to be filled in with information from other sources.

=> In the RARF (Baseline Sheet 1 in Annex E) the Assessor shall record all information available about the site from GSN and lab reports on water and solid waste if available.

When information for the assessment is lacking, additional information available from MME's central and/or regional offices should be gathered and reviewed. Where necessary, information may also be sought from other public environmental services such as the DWA, MET, MAWRD, MOHSS, relevant municipalities, regional offices, the National Planning Commission, Namibian Chamber of Mines, and others. Information may also be found on the Internet. It is recommended that the enquiries sent to these entities be directed to key informants with practical knowledge of mining operations.

One or more field visits may be needed to gather information to describe the environmental and socio-economic situation of a site. During these visits it is sometimes beneficial to interview individuals residing or working in the surrounding area.

3.2.2. Map Preparation

Special attention should be paid to the availability of maps, as these will serve as the basis for a number of aspects of the assessment. When initiating the assessment it is therefore important that the Assessor obtain the following elements from the MIDS and other sources:

- Official topographic maps scaled at 1:50,000, as available.
- Aerial photographs or orthophotographs from the Directorate of Surveys and Mapping.
- Satellite images that can be obtained from 'Google Earth'[1] (Plate 3.1) or Landsat images provided by NASA[2].

The quality of these elements may vary according to the sharpness of the images, graphic content and how recently they were taken. By comparing images from different sources the Assessor can determine which offers the best quality cartographic information.

Once the best source of information has been selected, the Assessor will proceed to prepare the **Risk Assessment Base Map (RABM)**. The Assessor will use this map on site to support the risk assessment process, and the recommended scale is 1:5,000 or higher. Obtaining this base map may entail one or more of the following tasks (the entries are listed in order of descending quality of the final product):

[1] http://earth.google.com/
[2] https://zulu.ssc.nasa.gov/mrsid/

- Printout of a satellite image (e.g. Google Earth) or aerial photograph, geo-referenced to exact scale (1:5,000 or more detail). This is the most desirable option and requires high quality digital cartographic information and colour printing facilities.

- Colour photocopy of the topographic map (1:50,000), increasing the scale where possible.

Plate 3.1: Google Earth image of Klein Aub mine showing the relationship between the old tailings dam (centre) and the village (left)

Once the base map has been chosen and printed or enlarged, this will serve as the RABM. The RABM is the cartographic document to which all field notes will refer and upon which measurements will be based, although other existing maps, photographs and/or images may also be useful at different stages of the assessment and for specific tasks. The RABM must include the coordinates and document its projection system – preferably one which supports GPS coordinates.

To determine which map projection was used for a map, satellite image and/or aerial photograph, the Assessor should consult the written documentation accompanying each item. For official topographic maps the projection is clearly indicated on the map itself. Where aerial photographs are used, the text files accompanying the digital maps should be reviewed for this information. The Assessor can also refer to the metadata[3] for these images published on the Internet. Similarly for satellite images, the projection used can be verified by referring to the documentation that accompanies each image.

=> In the RARF (Baseline Sheet 2 in Annex E) the type of cartographic information available will be logged, as well as the main features of the RABM (scale, projection system, etc.).

From the review of the topographic maps and/or images obtained, the Assessor should be able to

[3] Metadata: Data about data.

obtain a precise idea of the topography of the site and local water systems. By studying the photographs and satellite images the Assessor can also obtain a general overview of the surrounding area, including an idea of the general land use patterns, the presence or absence of water courses and water bodies, the location of populated areas, and so on.

The preparation of the base map is a crucial stage in the assessment, as it will serve as the basis for information collected during the risk assessment process, such as:

- Distances from the site to drainage bodies and other receptors;
- The form and size of river catchments and sub-catchments, which can be used to determine rainfall runoff and flow volumes which may affect the site;
- The direction of surface runoff flows.

Two or more copies of the RABM should be printed and one should be reserved for preparing a final, 'clean' version.

3.2.3. Definition of the Area of Study

Once the available information has been analyzed and the RABM is ready, the Assessor should define the Area of Study. This is the zone that could potentially be affected by the abandoned or shut down mine site in terms of risks present to human health and safety, the environment and/or economic activities.

The **preliminary** boundaries of the Area of Study should be established before the first field visit, with the boundaries traced directly onto the RABM. The final boundaries of this Area will be determined later when the SD/AMS and surrounding areas are visited.

The Area of Study should be established on a case by case basis, and should include:

a) the entire **area occupied by the site** when it was in operation; plus

b) the areas **that could be affected**, directly or indirectly, by contamination or safety related events (such as the sudden release of tailings from a failed tailings dam).

The criteria to be applied in the case of (b) are as follows:

b.1) Included in the Area of Study are **surface water courses** (perennial, seasonal and ephemeral rivers[4], drainage lines and washes, wetlands, farm dams, etc.) that could be

[4] A perennial river or stream is one which flows throughout the year; a seasonal river or water course is one which flows for a few months, usually every year but only during the rainy season; an ephemeral watercourse is one which only flows for a short time (days or weeks) following rain in its catchment area. The latter may not flow for several years.

affected by drainage or runoff containing contaminants from the mine site. The length of the watercourse to be considered within the Area of Study will be determined by the point below which, in the Assessor's judgment, no adverse effects from the site will be experienced. Criteria to be used in determining this point may include:

- Location where contamination is no longer detected, using pH readings;
- Location where turbidity (by sight) or the presence of salts (recorded with a conductivity sensor) attributable to the SD/AMS are no longer recorded;
- Location where an increase in biodiversity is noted (vegetation reappears on the banks of a water course, for example).

For the purposes of the assessment, measurements taken upstream from the site should be compared with different points downstream from the site.

b.2) Also included in the Area of Study are **groundwater aquifers** (primary and secondary; perched and deep) that could be affected by seepage and infiltration from runoff containing contaminants from the mine site. The Assessor will determine the surface area to be included in the Area of Study based on field observations, map interpretation and borehole census data, if available.

b.3) In addition to the above, **soil, plants, human and animal receptors** downwind of pollution sources associated with the mine and process plant should also form part of the Area of Study. Dust may have originated from, and may continue to arise from stacks, tailings dams, waste rock dumps, low grade stockpiles, access roads, haul roads and open pit operations. The Assessor will define the distance from the site to be considered, based on field observations (i.e. visible dust lying on the ground or accumulating in the lee of bushes and hillocks), dust monitoring and/or modelling if available (Plate 3.2), and interviews with local residents.

The distance that dust will travel will depend on a combination of factors including: the particle size of the dust (finer particles will remain suspended in the atmosphere for days or even weeks, and can be dispersed over a wide area); the specific gravity of the particles; average moisture content; and prevailing wind speed and direction.

If the SD/AMS plant had gaseous emissions, there may be a residual plume area where soils and other receptors may have been affected (Plate 3.2). If the mine conducted air quality monitoring during operations and/or modelled gaseous emissions, then this information should be available on the MIDS. But for most of the older SD/AMS the critical information required to determine the area of influence (e.g. stack height, emission velocities and temperature etc) and all relevant weather data are unlikely to be available.

Thus the Assessor will need to rely on other information such as the type of process plant used, the typical gas emissions associated with that type of plant, and whether there is visible evidence of a gas plume in the downwind direction, such as trees with the 'stag horn' effect[5], dead or dying vegetation, rusting roofs of houses and anecdotal evidence from nearby residents.

b.4) **Soil** that might be contaminated from the disposal or spillage of any hazardous or polluting materials e.g. tailings, hydrocarbons, sulphuric acid etc., should be included within the Area of Study. Annex A (section A.2.2.2) includes criteria for calculating the Area of Study in such cases.

b.5) Also included in the Area of Study are **residential zones** that regularly consume agricultural, livestock, game, fishing or aquaculture products from the areas indicated in the above points (Plate 3.2). In other words, the inhabited sectors whose regular food supply includes products grown in or obtained from an area affected by the site.

=> In the RARF (Baseline Sheet 2 in Annex E), areas that could be affected by the site will be identified and a brief rationale given for their inclusion.

In summary, after a preliminary analysis of the mine site, waste deposits and processing plant, the Assessor should include on the map: (a) the areas these occupy; and (b) their respective zones of influence.

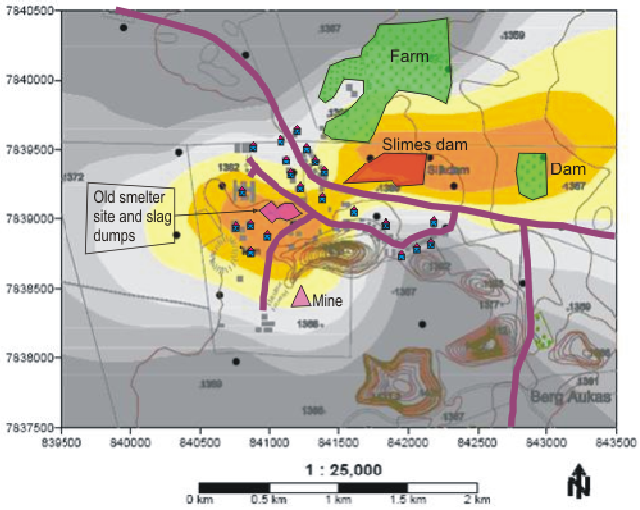

Plate 3.2: Map of Berg Aukas mine showing the extent of pollution beyond the mine structures. The map also highlights residential areas. This type of map helps to define the Area of Study

[5] Severe gas pollution can cause the upper branches of trees to die and lose their leaves, giving it the effect of a stag's horns.

3.2.4. Description of Receptors in the Area of Study

The Assessor shall determine which receptors are present in the Area of Study. This task begins in the office, where the information gathered is analyzed and observations are made about the cartographic information and satellite images.

Later, during the field visit, the receptors identified will be confirmed and the information required for the assessment will be collected. In certain cases it may be desirable to conduct interviews with local residents to collect additional information the Assessor deems necessary (water uses, distance of visible dust, human activity within the Area of Study, etc.). For the purposes of this Handbook, receptors have been grouped into three main categories: People, the Environment and Economic Activities; each of these should be described using the procedure outlined below.

3.2.4.1 People

All individuals residing in or visiting the Area of Study of the SD/AMS are considered potential receptors. These groups of individuals may be exposed to risks from both unsafe elements and contaminants.

Residents include all individuals living permanently in the Area of Study of the SD/AMS (Plate 3.3). Potential visitors include people coming to the site for tourism, recreation, sports and/or for economic reasons such as to graze animals, farm the land, or obtain construction material (Plate 3.4) or scrap metal, etc.

Similarly, if the Area of Study contains drinking water intake works for a given population that lives outside of the Area of Study, these individuals should be considered potential receptors that may be affected by the site.

Plate 3.3: The village next to Otjihase mine frequently experiences dust from the tailings dam (in foreground). The residents of this village therefore live within the Area of Study.

Plate 3.4: Contractors at Berg Aukas have been removing slag and fly ash for brick making from the dump leaving a dangerous, unsafe working face. It has also been found that this ash and slag are toxic.

The following information is required to characterize receptors **living** in the Area of Study:

- Name of locality
- Type of settlement. Possible types include:
  - City. Urban centre with more than 100,000 inhabitants.
  - Town. Urban centre with between 5,000 - 100,000 inhabitants.
  - Village. Rural population centre with less than 5,000 inhabitants.
  - Farm. A commercial farm with several houses and cottages on the property belonging to the farm owner, farm manager and the farm workers.
- Coordinates for the settlement. When it is a small village the coordinates at the centre should be recorded. For farms, the location of the main farmhouse, and the residential building nearest the mine site (if it is different to the main farmhouse) should be recorded. For larger places (towns and cities) coordinates should be recorded at both the centre and the edge of town closest to the mine site.
- The age profile of people living permanently in the Area of Study.
- Identification of surface water collection points for human consumption and stock watering points. Provide GPS coordinates or identify on a map.
- Existence of wells supplying groundwater for human and stock consumption. Geographic location. Provide GPS coordinates or identify on a map.
- Existence of fountains and springs located downstream from the mine site.

To characterize **visitors** to the site, the following information should be collected for individuals who are not permanent residents of the Area of Study but who enter the mine site with some frequency:

- Number of visitors entering the site, estimated frequency of visits and reasons for visit.
- Mode of entry.

- Purpose of entry e.g. for fishing, quad biking, grazing, recovery of materials (Plate 3.4).
- City or town of origin.
- Ages of individuals entering the site, with special attention to the entry of children and/or youth.

It is important that this information is corroborated with local inhabitants, particularly with regard to the number and frequency of visitors to the site and the existence of drinking water within the Area of Study.

=> Where appropriate, the presence of individuals residing in or visiting the Area of Study, along with the information indicated above, will be logged on the RARF (Baseline Sheet 3 in Annex E).

3.2.4.2 The Environment

The SD/AMS risk assessment also requires a description of the environment on and surrounding the mine site. This refers to the natural and cultural elements whose presence in the Area of Study should be recorded. In this Handbook environmental receptors have been divided into three categories: aquatic life, terrestrial fauna and flora, and protected or environmentally sensitive areas.

Aquatic Life

For the SRA, it will be assumed that all surface water bodies and watercourses (perennial, seasonal and ephemeral) have aquatic life as potential receptors. Bodies of water include rivers, streams, lakes, dams, wetlands and vleis, fountains and springs, lagoons, salt flats, and the coastline.

To enable the assessment of the magnitude of risk that a SD/AMS poses to aquatic life, the Assessor should estimate the surface area and/or length of water bodies present in the Area of Study. Once the dimensions of the water bodies present in the Area of Study are known, any **aquatic species** in that area with an official protected status must be identified (e.g. listed on the IUCN Red Data List under the following categories: Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern[6], or listed as protected under Namibian law). In addition, a list of species caught for human consumption must be made. This will result in a description of especially relevant species that could be affected by the Hazard Scenarios present in the SD/AMS.

[6] www.iucnredlist.org

In order to carry out an informed SRA on the environment, it is recommended that the team should include an ecologist who is trained to look at indicators of environmental health. Basic key indicators of aquatic health which should be observed on site include:

- The health of riverine vegetation (reeds, grasses, trees);
- Presence of fish;
- Presence of dead fish, birds and animals;
- Piscivorous birds such as egrets, herons, kingfishers, hammerkop, ducks, fish eagle;
- Birds which feed on aquatic invertebrates and plants such as most waders, ducks, coots, moorhens;
- Bird and animal foot prints in the mud along the edge of the water;
- Presence of dragonflies, water beetles, molluscs and other invertebrates;
- Frogs (calling);
- Water quality indicators such as colour, turbidity, salt crusts, algal blooms, temperature, flow status.

Terrestrial Fauna and Flora

For the risk assessment it must be assumed that the Area of Study contains wild flora and fauna as potential receptors. To address this aspect, first the Assessor will estimate the surface area of all land inside the Area of Study using the means at his or her disposal (maps, images, etc.).

Along with this, a general description of the terrestrial flora and fauna present in the Area of Study and the surrounding area should be prepared. In particular it is important to determine whether there is evidence of any officially protected flora and/or fauna species (see above) and whether any species are harvested for human consumption.

Some of the required information can be obtained from MET and from published sources such as the Atlas of Namibia (Mendelssohn et al. 2002) before going to site, but this will need to be augmented by observations made on site by a trained ecologist. Some of the information that needs to be recorded includes:

- Types of ecosystems represented (woodland, savanna, succulent karoo, desert, etc.).
- Health of the vegetation, including indicators such as cover density, species diversity, growth forms, discolouration and the presence of invader species.
- Presence of main species of fauna and flora inside the Area of Study, with special reference to protected species.

- Presence of dead specimens.
- Tracks and signs of the presence of animals such as tracks, droppings, signs of feeding (browse lines, grazing pressure), scent marks, shed skins (reptiles), skulls, etc.
- Estimation of abundance (where applicable).
- Conservation status, including whether the species is endemic (where applicable).

Protected or Environmentally Sensitive Areas

The Assessor should identify the proximity or inclusion of Protected or Environmentally Sensitive Areas in the site's Area of Study. The information can be obtained from MET and from published sources such as the Atlas of Namibia (Mendelssohn *et al*. 2002) and should include:

- Presence or proximity of Protected or Environmentally Sensitive Areas in the Area of Study.
- Name of Protected or Environmentally Sensitive Area.
- Conservation status or protection category. These may include:
  - National Parks;
  - Game Parks;
  - Recreation Areas;
  - Private Nature Reserves;
  - Conservancies;
  - Marine Protected Areas;
  - Ramsar sites;
  - Important Bird Areas;
  - Trans-frontier Conservation Areas (TFCAs).
- Areas of natural or cultural value, such as: groundwater conservation areas; National Monuments; and forest reserves.
- Environmental components that could be affected by the safety and/or contamination of a SD/AMS (soil, natural vegetation, wildlife, water bodies, cultural heritage sites, etc.).
- Source of information consulted.

> ***=>*** *In the RARF (Baseline Sheet 3 in Annex E) environmental elements present in the Area of Study are recorded, along with basic information requested in each case.*

3.2.4.3 Economic Activities

SD/AMS can threaten economic activities such as crop farming, game farming and livestock activities, tourism, fishing and aquaculture. Because of their importance for subsistence and economic development, this Handbook considers such activities to be potential receptors of the risks identified.

Where productive areas are located inside the Area of Study, these should be included in the risk assessment. It is best to estimate the area used and therefore potentially affected by the site, as this will determine in part the magnitude of the risk assessed.

Tourism

The information which needs to be collected regarding tourism is:

- Types of tourism carried out in the Area of Study.
- The area(s) used for tourist activities.
- Number of residential units in or adjacent to the Area of Study (e.g. lodges, chalets, camp sites, etc.).
- Number of people employed in tourist activities in the Study Area on a permanent or temporary basis.
- Number of people who visit the Area of Study every year.

Plate 3.3: Old crumbling mine infrastructure can pose a safety risk to tourists, as at this old building at Bogenfels Mine in the Sperrgebiet

Agriculture: crop production

The following aspects will need to be documented in this regard:

- Type of productive activity –specify crops.
- Area and location in relation to the Area of Study and distance from the site.
- Location and method of extracting irrigation water.

- Identification of the level of production:
  - Subsistence;
  - Communal;
  - Commercial.
- Number of people who regularly eat crops potentially affected by the SD/AMS.
- Number of individuals working in agricultural production and their employment pattern throughout the year.

Agriculture: Game farming and livestock activities

Make a note of the following:

- Type of productive activity – specify species farmed.
- Area used for the activity, its location *vis à vis* the Area of Study and distance from the site.
- Location and method of extracting drinking water for animals or location of water source where animals drink.
- Identification of level of production:
  - Subsistence;
  - Communal;
  - Commercial.
- Number of people who regularly consume animal products (meat, milk, eggs) potentially affected by the SD/AMS.
- Number of individuals working in this activity and their employment pattern throughout the year.

Aquaculture and Fishing

The information to be gathered in this case includes:

- Type of productive activity – list species farmed.
- Location of the activity in relation to the Area of Study, distance from the site.
- Identification of the level of production:
  - Subsistence;
  - Communal;
  - Commercial.
- Number of people who regularly eat fish or aquaculture products potentially affected by the SD/AMS.

BOX 1
CASE STUDY: BERG AUKAS

Berg Aukas was a lead-zinc-vanadium mine that was operational on and off from 1920 to 1979. Subsequently the area was used mainly for agriculture and the abandoned mine buildings have been used as a Youth Training Centre since the early 1990s.

In 2005 and 2007, comprehensive geochemical surveys were conducted at the site to analyse the contamination of water, soils, forage and crops to determine if there were any health risks.

The study showed that most parts of Berg Aukas are severely contaminated with lead, zinc, cadmium, arsenic and vanadium, particularly in the soils of the old ore processing area (see Plate 3.2).

The abandoned mine tailings and slag dumps have been left unattended since 1979 and show signs of severe wind and water erosion. This means that the effects of pollution, through the aerial deposition of heavy metal particulates, have been spread to areas far away from the source.

Zinc and lead levels in grasses used for forage on and around the tailings dam were found to be in excess of accepted 'safe' levels for dry forage.

The concentrations of arsenic, lead and zinc in cassava and sweet potato leaves as well as roots were found to be well in excess of WHO limits for food.

As a result of these studies, the Government of Namibia relocated the National Youth Service training camp and famers have been informed about the levels of contamination in forage and crops around the tailings dam.

This demonstrates the importance of conducting a thorough risk assessment prior to land use decisions being made on old mine sites.

Since this section deals with identifying productive activities, it is important that the Assessor interviews local inhabitants and officials, as these individuals will have information on traditional productive activities and new development projects that may be planned for the future.

=> In the RARF (Baseline Sheet 3 in Annex E) economic activities observed in the Area of Study will be identified along with the basic information requested about them.

3.2.5. Preparing the Field Visit

For preparing the field visit, this Handbook has a **Guide for Preparing and Implementing the Field Visit,** available in print and digital format (Annex F). Assessors should review this Guide **before the field visit**, to ensure that the Assessor remains safe during the visit and that the objective of the trip is fulfilled. The Guide covers the following issues, among others:

- Confirm activities previously performed in the office.
- Define any third party interviews that have to be conducted beforehand.
- Offers a checklist for personal protection for the Assessor to use in the field.
- Provides a checklist of measuring instruments that may be necessary.
- Provides protocols for specific tasks that have to be carried out in the field.

A key aspect of planning at this stage is to put together the assessment team. Depending on the location of the SD/AMS and the nature of the hazards present, the team should include at least an Environmental Geologist and an Environmental Scientist familiar with the area of the site. For particularly dangerous sites, it may be advisable to include a mining engineer or civil engineer depending on the safety hazards present.

3.2.6. Summary of Assessment Preparation Stage

Once the administrative work is finished (described in sections 3.2.1 to 3.2.4), the Assessor should ensure preparations are complete and the following elements are available:

1. The **MIDS** containing all of the information collected about the site.
2. The **Risk Assessment Base Map (RABM)** showing the preliminary boundaries of the Area of Study for the site and also a preliminary identification of receptors.
3. The **RARF** (in Excel format) containing all information collected to date. This form will also be used for collecting information on site.
4. The **Guide for Preparing and Implementing the Field Visit**, duly filled out according to the conditions of the site being assessed.

3.3 Field visit

The field visit may last one or more days, depending on a number of factors such as the size of the site, its complexity and/or ease of access, climatic conditions, etc.

The specific objectives of this inspection are:

- Identify and describe the **mine workings, process plant and all wastes and deposits** present in the SD/AMS.
- Identify and describe the Safety and Contamination **Hazard Scenarios** present.
- Confirm the **boundaries of the Area of Study**, set out in preliminary form prior to the field visit.

- Identify and describe the **Receptors** present in the Area of Study (individuals, environmental components and economic activities).
- Gather the information necessary to estimate the **Likelihood of Occurrence** of each Hazard Scenario, considering the combination of circumstances.
- Gather the information necessary to estimate the **Severity of the Consequences** for each Hazard Scenario, taking into account the number of receptors involved and/or the severity of damage.

The sections below give a step by step description of how the Assessor should address each of the objectives outlined above during the field inspection:

3.3.1 Identification and Description of Installations, Deposits and Works

3.3.1.1 Identification of Installations, Deposits and Works

The Assessor should begin identifying the **mine workings, process plant and all wastes and deposits** at the SD/AMS with a walk-through. Each one of these elements should be identified with the corresponding code (section 4.1.2.1). Some criteria to assist the Assessor in identifying individual components on site are given below:

- All installations, deposits or works that the Assessor deems to represent a risk to human safety, to the environment, or to economic activities, should be specified. This means that each shaft and/or adit present on a site should be identified separately; similarly, individual quarries or pits that are not a continuous unit should also be identified individually, as should separate deposits of large scale and small scale mining waste and adjoining infrastructure (roads, storehouses, camps, etc.) located in distinct sectors.
- However, the Assessor should not specify minor installations, deposits or works that do not represent a safety or contamination risk; these may include small building structures, small mounds of topsoil or overburden, access tracks, etc.
- Due to their nature and size, ore treatment plants (in general) include different internal structures that represent distinct kinds of risks. The Assessor should identify the Plant as a single unit, describing the structures remaining inside (sumps, tanks, pipes, unstable walls, offices, etc.).
- Any installation, deposit or work located inside a plant will only be identified separately (including any kind of adjoining infrastructure) when the Hazard Scenario it represents is very different from those present in the plant itself. This would be the case, for example, for large waste deposits located inside such a plant.

3.3.1.2 Description of Installations, Deposits and/or Mine Works

Once the Assessor has identified the installations, deposits and/or works present, he or she must prepare a description of these, including their size and most relevant aspects for safety and/or contamination issues (see details in section 4.1.2.1).

=> All installations, deposits and works at the site will be recorded on the RARF (Cover page 2 in Annex E). To accompany the description, geographic coordinates of the place and digital photographs showing the general state of that element should be included.

3.3.2 Identification of Hazard Scenarios for each Installation, Deposit or Work

As a second step in the field, the Assessor should identify **Hazard Scenarios** that are present at each of the installations, deposits and or works (see details in sections 4.1.2.1 and 4.2.2.1). To determine these, the Assessor should consult Tables 4-3 and 4-10, which enumerate all scenarios considered within the scope of this Handbook.

Classification of waste present on site, e.g. **hazardous waste** (whether in deposits, in remnant indoor structures, or contaminated equipment or soil), should be made by the Assessor based on the Pollution Control and Waste Management Act[7], administered by the MET. In most cases a sample of the waste will need to be taken (using bottles or plastic bags) for analysis in the lab. Each sample obtained in the field should be labelled by the Assessor (with permanent marker) with a code identifying the SD/AMS, the Hazard Scenario from which it was obtained, the number of the sample, and date obtained.

=> The RARF will contain a record and description of the Hazard Scenarios present (SHS Step 1 and CHS Step 2 in Annex E). The Assessor should take digital photographs to suitably illustrate the scenarios identified. The images can be inserted in digital format into the RARF (Appendix 3 Photographs).

3.3.3 Drawing the Boundaries of the Area of Study

During the field inspection, the Assessor will define the area that could be affected by the negative impacts (safety or contamination) of each of the scenarios being assessed. These observations will enable the delimitation of the **Area of Study** associated with each Hazard Scenario identified on the

[7] This Act is still to be promulgated.

site. Any adjustment to the Area of Study made by the Assessor in the field should be recorded on the RABM that was brought to the site.

3.3.4 Characterization of Receptors for each Hazard Scenario

Once the perimeter of the Area of Study has been confirmed, the Assessor may now turn to identifying the **Receptors** present in the area. The observations made during this inspection will allow the Assessor to correct and/or complete the information gathered in the preparatory stage. This includes confirming the number of individuals that inhabit or visit the Area of Study, the presence of crops, livestock, etc. During this process the Assessor may decide to gather additional information by interviewing individuals residing in the area surrounding the SD/AMS.

It should be noted that each Hazard Scenario identified on site will have its own kind and number of associated receptors. For example, tailings from a deposit that are blown by the wind will affect receptors situated within the area of influence of the contamination plume, while the release of contaminants from this same deposit, such as runoff after rainfall, may affect a different group of receptors located downriver. As a result, the Areas of Study and receptors may be quite different for each Hazard Scenario.

=> Once the inspection of receptors is concluded, the Assessor should record the results on the RARF (Baseline Sheet 3 in Annex E).

3.3.5 Field Information Required to Determine the Likelihood of Occurrence of each Hazard Scenario

For each of the Hazard Scenarios identified as either a safety or contamination concern, the Assessor should collect the field information required to determine its **Likelihood of Occurrence**. To assist the Assessor in determining the Probability in each case, the Handbook provides a series of Guides for Calculating the Probability Index (Annexes A1 and B1). The Assessor should take copies of these Guides into the field in order to select the most suitable one on site and record all of the information required.

=> The Assessor will record the information required for estimating the Probability Index of each Hazard Scenario on the RARF (SHS Step 2; CHS Step 3 in Annex E).

3.3.6 Field Information Required to Determine the Severity of the Consequences for each Hazard Scenario

Once all potentially affected receptors have been characterized, the Assessor can now apply the criteria specified in the Handbook to determine the **Severity of the Consequences** for each Hazard Scenario (see details in section 4.1.2.3 and 4.2.2.4). To do this, the Assessor will use Tables 4-6 and

4-14 to assign a value to this indicator based on the number of receptors potentially affected and/or the seriousness of any harm that may be caused.

=> In the RARF (SHS Step 3; CHS Step 4 in Annex E) the Assessor will record the Severity Value obtained for each Hazard Scenario.

This process should be repeated for each installation, deposit or work identified for the site.

3.3.7 Final Review of Field Inspection

The field visit concludes with a review of all the information gathered. At this time the Assessor must ensure that: (1) all installations, deposits and works have been visited; (2) all Hazard Scenarios present on site have been described; and (3) enough information has been collected to enable the estimation of Likelihood of Occurrence and Severity of the Consequences.

It is crucial that the Assessor record all pertinent information from the field visit on the RARF. This information will support the assessment, provide grounds for conclusions drawn, and facilitate any subsequent reviews by other government officials. The information recorded includes not only the technical matters addressed in this Handbook but also any observations that may be useful for subsequent site visits, especially in regard to access and/or safety conditions.