

LANGER HEINRICH URANIUM ENVIRONMENTAL MANAGEMENT PLAN

SECTION C

MONITORING PLAN

C.1 INTRODUCTION

The various MMPs have covered various aspects of monitoring. This section both augments those requirements and sets further detail where relevant.

As a general approach, the monitoring programmes will comprise the following:

- A formal procedure.
- Appropriately calibrated equipment – weekly inspections and calibration of equipment will be undertaken in line with the equipment calibration/validation procedure.
- Where samples require analysis they will be preserved according to laboratory specifications.
- An accredited, commercial laboratory will undertake sample analyses.
- Parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority.
- If necessary, following the initial monitoring results, certain parameters may be removed from the monitoring programme in consultation with a specialist and/or the relevant authority.
- Monitoring data will be stored in a structured database.
- Data will be interpreted and reports on trends in the data will be compiled by an appropriately qualified person on a quarterly basis.
- Both the data and the reports will be kept on record for the life of mine.

As a general comment, if monitoring points become damaged or redundant then they can be replaced with new points with the input of an appropriately qualified professional.

C.2 WATER MONITORING

Table C. 1 and Table C. 2 below set out the minimum monitoring points, programme and parameters for monitoring water resources at the mine. The relevant monitoring points are shown on Figure C. 1. The parameters may be modified on the basis of input from an appropriate specialist and/or relevant authority. In addition to the above, the mine will record rainfall and evaporation data on a daily basis. Any groundwater contamination detected by the mine will be reported to relevant authorities and the mine together with an appropriate specialist will design and implement appropriate treatment solutions.

In terms of groundwater levels, the results will be compared to simulated water levels. The water qualities will be compared to relevant water quality guidelines.

The flow of water in rivers, when applicable, will be monitored through a visual inspection and measuring stick methods.

Reporting will be undertaken at regular intervals (at least bi-annually) during operations.

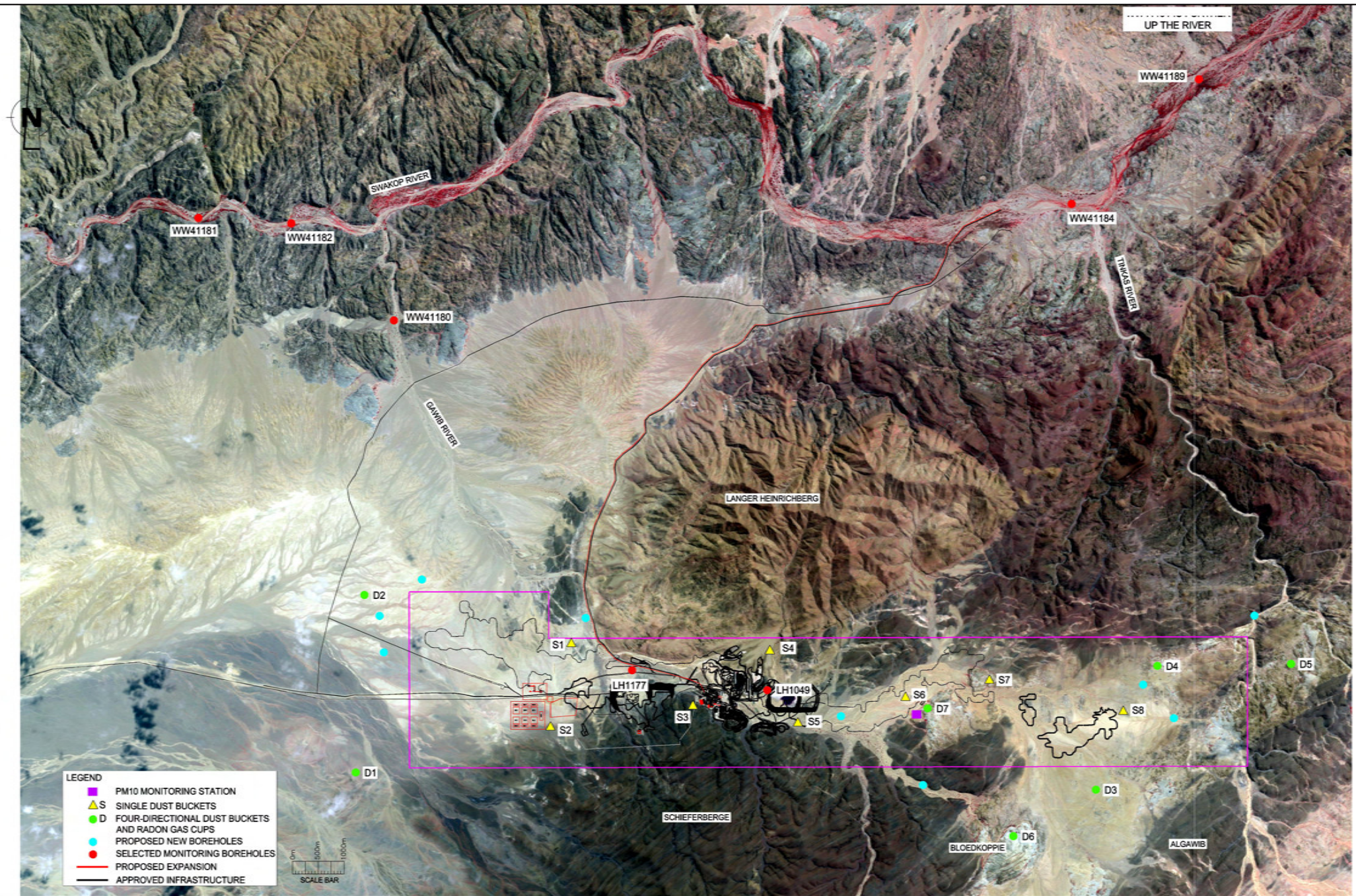


Table C. 1: Water monitoring programme

BH / Sample	Location/Comment	Quality	Water level	Volumes
Production wells				
WW41183	In Swakop River	Annually	Monthly	Daily
WW41188 (potential for future)		Annually	Monthly	Daily
WW41190 (potential for future)		Annually	Monthly	Daily
In-pit dewatering	In open pits	Monthly, where possible		Daily, where possible
Observation wells				
WW41191	In Swakop River, upstream of confluence with Tinkas River	Annually	Monthly	-
WW41189		Annually	Monthly	-
WW41184	In Swakop River, downstream of confluence with Tinkas River and upstream of confluence with Gawib River	Annually	Monthly	-
WW41181	In Swakop River, downstream of confluence with Gawib River	Quarterly	Quarterly	-
WW41182		Quarterly	Quarterly	-
WW41180	In Gawib River, downstream of mine	Quarterly	Quarterly	-
LH1177	In Gawib River, within mining operations	Quarterly	Quarterly	-
LH1049		Quarterly	Quarterly	-
New boreholes	Additional up- and downstream boreholes (of the Gawib) drilled in clusters of three to cover the three aquifers. Final positions to be determined in consultation with specialist. Existing boreholes to be used where possible.	Quarterly	Quarterly	-
New boreholes	Third party boreholes of the closest farmers located to the north of the LHU abstraction boreholes. To be determined in consultation with farmers.	-	Monthly	-
Surface water				
Next to WW41184 and WW41181	Up- and downstream of the Gawib and Swakop River confluence	When available, after rainfall events		
Next to proposed new borehole positions and WW41180	Up- and downstream of the ML in the Gawib River	When available, after rainfall events		
Next to proposed new borehole position	In the Tinkas River	When available, after rainfall events		
Effluent (domestic and industrial)				
All dirty water holding facilities	Within mining operations	Monthly	-	Daily
Treated effluent from sewage plant		Monthly	-	Daily
Tailings return water		Monthly	-	Daily
Reverse osmosis plant effluent		Monthly	-	Daily

Table C. 2: Monitoring parameters

PARAMETERS FOR ANALYSIS AND REPORTING			
Main Ions	Main Ions	Metals	Radio-nuclides
pH	Nitrate as N	Arsenic as As	U-238
Electrical conductivity	Sodium as Na	Bismuth as Bi	U-235
Turbidity	Potassium as K	Cadmium as Cd	U-234
Total dissolved salts	Magnesium as Mg	Copper as Cu	Ra-226
p-Alkalinity as CaCO ₃	Calcium as Ca	Mercury as Hg	Ra-223
Total alkalinity as CaCO ₃	Manganese as Mn	Selenium as Se	Ra-224
Total hardness as CaCO ₃	Iron as Fe	Tellurium as Te	Ra-228
Ca-Hardness as CaCO ₃	Stability pH, at 25 ^o	Uranium as U	Po-210
Mg-Hardness as CaCO ₃	Langelier Index	Vanadium as V	Th-232
Chloride as Cl	Ryznar Index	Other	Th-228
Fluoride as F	Corrosivity ratio	Groundwater level	Pb-210
Sulphate as SO ₄		Temperature	

C.3 AIR MONITORING

The current dust fallout (TSP) network will be expanded to measure both impacts on sensitive receptor sites as well as ecologically sensitive areas. The dust buckets will be placed immediately downwind of activities and at key areas around the ML. The conceptual layout of monitoring points is shown on Figure C. 1. Dust fallout monitoring points will also be placed in some of the key vegetation communities that LHU will set aside as conservation areas. Monitoring will be undertaken using the American Society for Testing and Materials standard test method for the collection and analysis of dustfall (ASTM D-1739) or any other method which can demonstrated to give equivalent results (SANS, 2004). The buckets will be monitored on a quarterly basis.

The target on-site (immediately adjacent to mine activities) dust fallout reading should be 1200mg/m²/day. The target off-site (at the nearest sensitive receptor sites – Bloedkoppie, drillers camp, construction camp) dust fallout reading should be 600mg/m²/day. The absence of a visible dust plume along haul roads, at all tipping points and outside the primary crusher would be the best indicator of effective control equipment in place.

The existing PM10 monitor will be moved to the drillers camp to monitor ambient concentrations. PM10 monitoring will take place on a quarterly basis.

The operation of the on-site meteorological station will be continued.

Reporting will be undertaken at regular intervals (at least bi-annually) during operations.

C.4 BIODIVERSITY MONITORING

The monitoring program will include:

- Areas set aside as conservation areas will be monitored on a weekly basis during construction and a monthly basis thereafter to ensure that no disturbance occurs.
- Where areas are to be disturbed and later restored, a representative control site (an area of similar biodiversity attributes that will not be disturbed) will be monitored, by an appropriately qualified specialist, across sufficient seasons to establish restoration targets that take seasonal variation into account. The targets will be set in consultation with MET (Parks and Wildlife). Once the targets are defined, these will be used to determine the success of restoration. As an example, a relevant invertebrate target is the re-establishment of an indicator group such as the wasps of the family Pompilidae, because these wasps will only exist where the necessary components of the ecosystem have been established.
- Monitoring of the rehabilitated areas will continue seasonally until the rehabilitation targets have been reached and there is no possibility of further disturbance by mining activities.

- Monitoring could be done either through capture-identify-release methods or visual counts of individuals along a transect.

The monitoring programme will also include:

- Regular inspections to ensure that the land disturbance procedure is being implemented, as required. The results of the inspection will be incorporated into LHU's EMS.
- Regular monitoring and periodic checks on the following: the footprint being disturbed by contractors, whether the spillage management programme is being implemented, that biodiversity is not being unlawfully removed from the area.

Reporting will be undertaken at regular intervals (at least bi-annually) during operations.

C.5 RADIOLOGICAL MONITORING

The radiation monitoring will include the following:

- Groundwater monitoring as per specified in Section C.2. In this regard, the radionuclide analysis will be done on a bi-annual basis for a period of at least three years and thereafter on an annual basis.
- As part of the dust and PM10 monitoring programme specified in Section C.3, a radionuclide analysis will be done on a quarterly basis.
- Once-off confirmatory radon gas monitoring [emission concentration and rates (flux)] will be undertaken at major exposure sources such as the tailings facilities, mineralised stockpiles and the open pits. This data will be used to verify the information used in the NECSA 2009 assessment.
- Ambient radon gas monitoring will be undertaken at areas around the ML on a quarterly basis. Radon cups will be placed at all dust sampling sites as illustrated in Figure C. 1.
- Once-off confirmatory sampling of radioactive dust sources such as the tailings facilities, mineralised stockpiles and the open pits will be analysed for a full suite of radio-nuclides. This data will be used to verify the information used in the NECSA 2009 assessment.

Reporting will be undertaken at regular intervals (at least Bi-annually) during operations.

C.6 RESOURCES

The amount of consumed resources such as electricity, fuel, water and manufactured materials will be monitored on a daily basis in line with the respective management procedures. Related reporting will be conducted monthly.

C.7 SOIL (STOCKPILING)

Weekly inspections of soil stockpiles and rehabilitated areas will be undertaken to ensure that the soil conservation procedure is being implemented. The results of the inspection will be incorporated into LHU's EMS.

C.8 WASTE, DIRTY WATER SYSTEM AND HEAP LEACH PAD

C.8.1 Mineralised waste, dirty water system and heap leach pad

The following issues will, where relevant, be monitored on a quarterly basis and reported bi-annually:

- Phreatic surface, slope stability, adequacy of freeboard, integrity of walls/liners, the position of the pools, silt trap sediment, presence of seepage, capacity of dirty water system, and functioning of drains.
- The success of rehabilitation measures.
- The effectiveness and integrity of infrastructure that prevents erosion damage and provides flood protection.

In addition to the above, the volume of mineralised waste (including low grade ore) generated as well as the disposal area, height and footprint of mineralised waste disposal/storage facilities will be monitored and recorded as required. The results will be reported bi-annually.

C.8.2 Non-mineralised solid and liquid waste

Weekly inspections of non-mineralised waste handling and management facilities will be undertaken to ensure that the waste management procedures are being implemented. The results of the inspection will be incorporated into LHU's EMS.

In addition to the above, the volume and type of non-mineralised waste, and the disposal destination, will be monitored and recorded as required. The results will be reported bi-annually.

C.9 GENERAL

C.9.1 Audits & inspections

The environmental manager and/or the environmental specialist will conduct internal management audits against the commitments in the EMP. During the construction phase, these audits will be conducted every month. In the operational phase, these audits will be conducted on a bi-annual basis. The audit findings will be documented for both record keeping purposes and for informing continual improvement. In addition, an independent professional will conduct an EMP performance assessment every 2 years. The mine's compliance with the provisions of the EMP and the adequacy of the EMP relative to the on-site activities will be assessed in the performance assessment.

The Environmental Coordinator and Environmental Technician will conduct daily inspections during construction and weekly inspections during operations.

C.9.2 Submission of information

As a minimum, the following documents will be submitted to the relevant authorities on an ongoing basis:

- EMP performance assessment, submitted every two years to MME and MET.
- Tailings and mineralised stockpile management and risk report, submitted bi-annually to MME, MHSS and MET and annually to DWA.
- Non-mineralised waste management and risk report, submitted bi-annually to DWA, MME MHSS and MET.
- Air monitoring reports, submitted annually to MME, MHSS and MET; and
- Water monitoring reports, submitted bi-annually to MME and MET and annually to DWA.

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