

# ENVIRONMENTAL MANAGEMENT PLAN

## Trekkopje Mine ML 151



October 2022



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## Acronyms

ECC	Environmental Clearance Certificate
ESIA	Environmental and Social Impact Assessment
EMP	Environmental Management Plan
GHG	Greenhouse gases
HSE	Health, Safety and Environment
HSE ENV PO	Environmental Policy
HSE ENV PR	Environmental Procedure
HSE ENV ST	Environmental Strategy
HSRP	Health, Safety and Radiation Protection
km	kilometre
km/h	kilometre per hour
km <sup>2</sup>	square kilometre
m	metre
mm	millimetre
MEFT:DEA	Ministry of Environment, Forestry and Tourism: Directorate of Environmental Assessment
NHC	National Heritage Council
NO <sub>x</sub>	Nitrous oxides (air pollutants)
NRPA	National Radiation Protection Authority (Ministry of Health & Social Services)
OMN	Orano Mining Namibia
PPE	Personal Protection Equipment
RMP	Radiation Management Plan
SO <sub>2</sub>	Sulphur dioxide (air pollutant)
TLD	Thermoluminescent dosimeter (to measure the gamma radiation dose)
VOC	Volatile organic carbon (air pollutant)

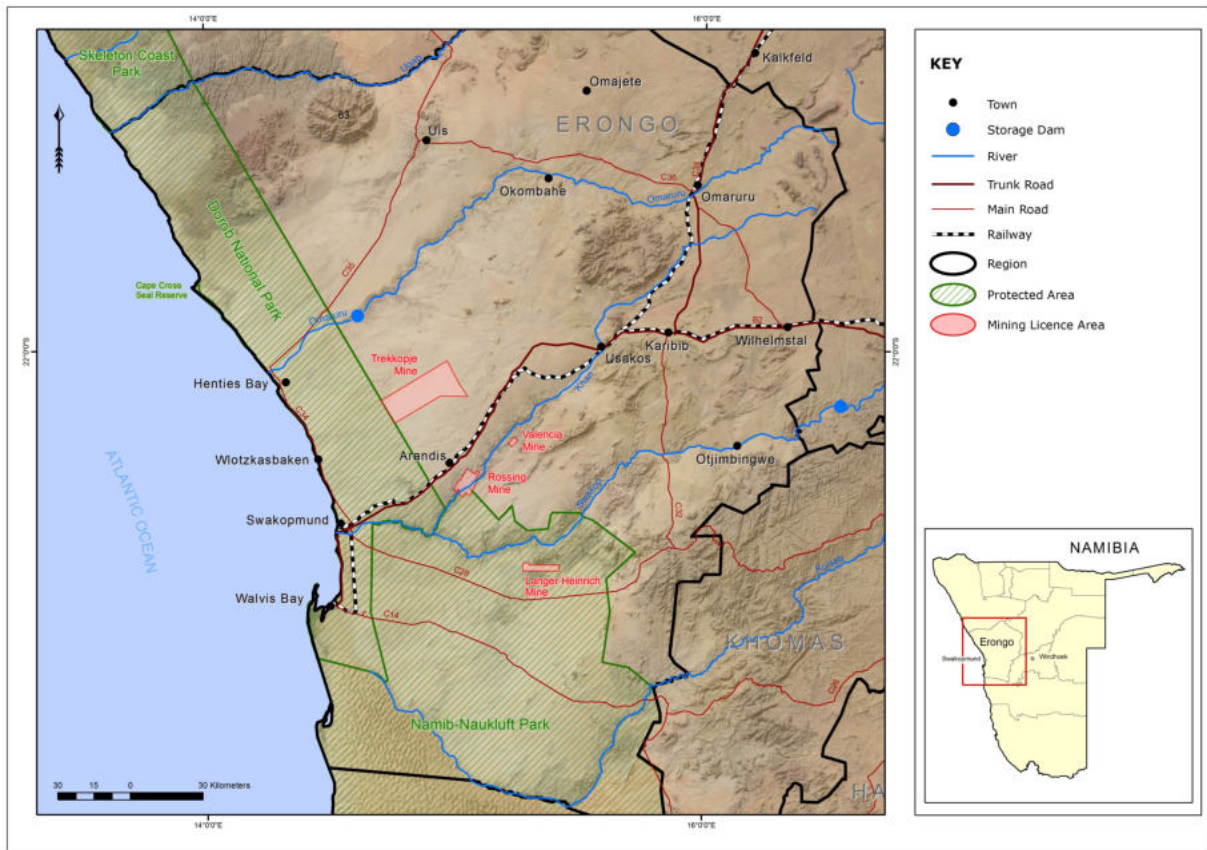
# 1 INTRODUCTION

## 1.1 AIM OF THE EMP

The purpose of this Environmental Management Plan (EMP) for Trekkopje mine is to document the actions to be implemented by the project proponent Orano Mining Namibia (OMN) to mitigate and monitor the impacts relating to the care and maintenance, operation and closure phases of the project. This EMP has been developed within the framework of an Environmental Policy and is based on the original approved EMP of 2008 and later amendments. Once approved by the Ministry of Environment, Forestry and Tourism: Directorate of Environmental Assessment (MEFT:DEA) as part of the renewal application of the environmental clearance certificate (ECC) issued in 2019, this EMP will supersede the previous version of the EMP compiled in 2016.

## 1.2 BACKGROUND

The French nuclear energy concern Orano (formerly AREVA) owns the Trekkopje uranium project through its local subsidiary Orano Mining Namibia (Pty) Ltd. The Trekkopje mining licence area ML 151 is situated within the Erongo region of Namibia, 70 kilometres (km) north-east of Swakopmund (Figure 1). Orano also owns the Erongo desalination plant at Wlotzkasbaken, 30 km north of Swakopmund, which was built to supply the mine, but currently produces water for the Namibia Water Corporation (NamWater).



## Figure 1: Locality Map

The mine will exploit a large, low-grade uranium resource using an alkaline leaching process that has never been applied at such a large scale before. The project was therefore developed in three phases, starting with two pilot testing phases in 2008-2013, while the main components of the full-scale processing plant were constructed. However, due to economic uncertainties, Orano decided to place the Trekkopje project under a care and maintenance programme in July 2013.

Care and maintenance means keeping the already constructed facilities in good condition without making modifications to existing infrastructure. Given that the project is well advanced and 80% of the required installations are in place, OMN intends to start mining as soon as there is a sustained upswing in the uranium market. In the meantime, Orano reassesses the economics of the project annually and OMN's corporate social investment programme continues with community initiatives in the areas of education, culture, sport and sustainable economic development.

### 1.3 ENVIRONMENTAL APPROVALS AND CLEARANCES

The first environmental approvals for the Trekkopje prospecting and exploration programme were obtained between 2006 and 2008. In 2008, an Environmental and Social Impact Assessment (ESIA)<sup>1</sup> was completed for the construction, operation and decommissioning of the mine. The ESIA, including an EMP, was approved by MEFT: DEA and a clearance certificate was issued in June 2008. During the same month, the environmental clearance certificate for the Erongo desalination plant was issued based on an approved ESIA and EMP.

The original EMP was amended in 2013 to replace some of the construction-specific mitigation measures in the 2008 EMP with measures that were more suited to the care and maintenance period. A few inappropriate mitigation measures that had not been updated in 2013 were amended in 2016. New clearance certificates valid for three years were issued in 2013 and renewed in 2016 and 2019 (see Appendix A). The current amendment, once approved, will supersede the 2016 EMP for Trekkopje ML 151.

Seeing that the current ECC will expire in December 2022, OMN will submit a renewal application together with an amended EMP which is in line with the current care and maintenance operations and the latest closure plan that was compiled in 2020. As part of this renewal application, further minor changes to the approved EMP have been made and highlighted in red in this document. These changes are largely in line with the current care and maintenance operations and the latest closure plan that was compiled in 2020.

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<sup>1</sup> Environmental and Social Impact Assessment Plan for the proposed Trekkopje Uranium Project, Turgis Consulting, 2008

## 2 PROJECT OVERVIEW

### 2.1 OPERATIONS

Trekkopje mine will exploit a large, low-grade uranium deposit in calcretised fossil river sediments with the main mineralisation covering an area of approximately 14 by 3 km. Mining of the Trekkopje deposit is an economic and technical challenge due to its very low ore content that requires an innovative processing method. Orano developed an alkaline heap leach process and performed extensive research at a column-testing facility and two pilot plants on site. A small heap leach pad and pilot plant was used in 2008-2009. This was followed by a medium-size demonstration production plant operating from 2010 to 2012, and the concurrent construction of a full-scale plant. The project was 80% complete but not yet commissioned, when it was put under care and maintenance in 2013 due to a slump in the uranium price. It is expected that better market conditions will allow the company to resume development in future.

### 2.2 CARE AND MAINTENANCE

The Trekkopje project has been under care and maintenance since the middle of 2013. The company currently has 17 permanent employees and around 40 contractors who are engaged in maintenance activities, administration and security services. Activities on the mine include testing and servicing of equipment and treatment against corrosion to protect the infrastructure so that the mine will be able to start up without major delays. The Erongo desalination plant continues to supply the mine with water, but mainly uses its spare capacity to supply desalinated water to NamWater.

### 2.3 CLOSURE PLANNING

In 2020, Orano Mining Namibia reviewed, updated and aligned its closure plan with Namibia's draft Mine Closure and Rehabilitation Framework currently being developed by the Ministry of Mines and Energy. Previous versions of the closure plan were compiled in 2010 and 2012. The plan presents the closure strategy, describes closure tasks and determines the financial requirements for Trekkopje mine's closure. These three components are embedded in the Namibian legislative and policy framework. The report also contains the results of closure-specific specialist studies, a closure risk assessment and a summary of key stakeholder engagements that were held to discuss the closure strategy.

A detailed closure risk assessment identified risks under the categories regulatory, workforce related, sustainability, site decommissioning, site rehabilitation, monitoring and aftercare, closure cost provision and company reputation. Management actions were developed for high and moderate risks. Major risks are associated with completion criteria and relinquishment of the land back to the state, the future of the workforce beyond mine closure and uncertainties about standards to be applied in the remediation of radioactively contaminated areas.

Vision and closure objectives were agreed for landscape remediation and social responsibility. These guided the development of specific tasks. Performance indicators and preliminary completion criteria have been developed to track the implementation of the tasks. The components of closure management at Trekkopje

mine include infrastructure demolition, landscape remediation, pollution management, biodiversity restoration, aftercare and social responsibility. Trekkopje mine is situated on state land, which fall under the !Oe-#Gan traditional authority and the #Gaingu Conservancy. The mine's infrastructure belongs to Orano, except for the power lines that were handed over to NamPower. The Erongo desalination plant, pipeline, and pump stations, as well as other structures that can be reused may be sold when the mine closes.

The closure plan describes the closure programme, rehabilitation and clean-up activities that will commence when the decision to close the mine has been taken. These will activities will extend for the estimated decommissioning period and will be followed by ongoing monitoring and aftercare. In addition to infrastructure demolition, the key tasks at closure revolve around the safe disposal of contaminated materials. Low-level radioactive tailings will be backfilled into the open pit and covered with a compacted soil layer to reduce radon exhalation to background levels so that the community can freely access the site. Contaminated waste materials will be buried in an existing granite quarry on site that will be adapted for this purpose according to hazardous waste site standards, unless a third-party operated hazardous waste site is available at the time of closure.

The cost of closing the mine either at the current stage of development (premature) or after having mined the deposit (planned) was estimated based on accepted accounting principles. In both scenarios the largest cost item is infrastructure demolition, followed by the removal of waste and landscaping of processing plant areas. Orano Mining Namibia has included a provision for the updated estimate in its budget.

The stakeholder consultation process started when the closure plan was reviewed and updated. Employees, regulators, service providers, contractors, landholders and others affiliated with sustainable development in the Erongo region were identified as the main stakeholders. Due to COVID-19 restrictions in 2020, only key stakeholders were consulted about the proposed approach and closure measures in the updated plan. Further stakeholder engagement is planned when the Namibian Closure Framework has been finalised.

## **3 ENVIRONMENTAL ASPECTS AND IMPACTS**

### **3.1 ASPECTS AND IMPACTS OF TREKKOPJE MINE**

The aspects and impacts of the mine are summarised in Table 1 including significance ratings with and without mitigation. OMN has reviewed and revised the ratings originally identified in the ESIA's based on research findings and experience gained since 2008. The highest impact of the mine arises from the destruction of flora due to land surface disturbance. The high significance is explained by the large area to be disturbed by mining, mineral waste facilities and infrastructure construction that will affect numerous plant species endemic to the Namib Desert. Other impacts classified as high without mitigation can be reduced to moderate or low by implementing appropriate management measures.

The mitigation tables in chapter 5 of this EMP show the actions in place or to be implemented to achieve the least possible negative impact on the environment and maximise the positive economic impact of the project. More details on the current state of the environment, including EMP audits and monitoring results, can be found in the company's biannual reports to MEFT.

**Table 1: Environmental Impacts and Significance Ratings for Trekkopje Mine**

Aspect	Impact	Significance without mitigation	Significance with mitigation
Atmosphere	Dust generation	M	L
Radiation	Radionuclide contamination of surface water	M	L
Radiation	Radionuclide contamination of groundwater	M	L
Radiation	Dust-borne radionuclides	M	L
Radiation	Radionuclide uptake by fauna	L	L
Radiation	Radon emanation	H-M	M
Radiation	Occupational exposure to radiation	M	L
Land surface	Soil disturbance	H	H
Land surface	Destruction or alteration of water courses	M	L
Soils	Water quality degradation from land surface impacts	L	L
Soils	Erosion/compaction	L	L
Soils	Pollution/salinization	L	L
Pollution risk	Pollution from chemicals/reagents	L	L
Pollution risk	Pollution from organic matter/sewage	L	L
Pollution risk	Pollution from other waste streams	L	L
Land use	Land-use change through land surface disturbance	M	L
Water	Groundwater pollution by spent rinse water	M	L
Water	Seepage from spent leach heaps	M	L
Water	Water consumption	H	H+
Water	Groundwater drawdown and flow disruption	L	L
Flora	Destruction through land surface disturbance	H	H-M
Flora	Destruction through dust generation or pollution	L	L
Fauna	General impacts	H	M
Traffic	Increased traffic volume	L	L
Traffic	Habitat destruction due to road development	M	L
Traffic	Increased access	L	L
Noise	Noise generated by blasting	L	L
Visual	Visual intrusion of infrastructure	L	L
Archaeology	Cultural/archaeological site pollution and damage	H	L

Key: H = high, M = moderate, L = low, + = positive impact



## 4 ENVIRONMENTAL MANAGEMENT

### 4.1 ENVIRONMENTAL POLICY

The Orano Mining Namibia environmental policy, version 2021, is shown in the box below.

***Orano Mining Namibia is committed to sustainable development and protection of the biophysical and social environment. Continuous improvement will be achieved through hands-on management and the impact of our operations will be controlled according to the mitigation hierarchy. The policy for the next three years will focus on four key objectives:***

**Maintain our facilities at a high level of safety to minimize impacts on the environment.**

- Avoid, minimize or offset environmental impacts, including those on biodiversity, by implementing the environmental management plan (EMP).
- Carry out environmental impact assessment for any new projects and compile reports as required by the Namibian regulators.
- Rehabilitate the mine site at closure to meet the defined closure objectives and ensure that final site conditions are compatible with future land use.

**Reduce the environmental footprint of our operation and minimize its impact on the biosphere.**

- Set targets to lower our water and energy consumption and greenhouse gas emissions.
- Monitor the effect of our operations on air, soil, groundwater and surface water quality, and take steps to control emissions.
- Maintain an appropriate waste management system and reduce the volume of waste that is not recycled

**Apply risk management systems and implement standards and safe work procedures to operate safely.**

- Review the site safety assessment and management system regularly and when conditions change.
- Pay attention to contractors' environmental performance at the purchasing stage and while working on site.
- Share experience from incident investigations as part of standard practice and implement identified improvement programmes.

**Maintain a dialogue with our regulators and comply with international standards.**

- Use opportunities to engage with the authorities and comment on proposed new legislation.
- Contribute to mining industry organisations such as the Namibian Uranium Association and the Chamber of Mines.
- Follow the International Atomic Energy Agency guidance on uranium mine operation and closure.

### 4.2 ENVIRONMENTAL OBJECTIVES AND TARGETS

The Orano head office sets environmental objectives and targets for its Mining business unit that are included in the Orano Mining Namibia EMP mitigation tables in addition to the mitigation measures identified in the ESIA. The objectives and targets are also documented in the OMN Environmental Strategy (document no. HSE ENV ST 05).

### 4.3 ENVIRONMENTAL STRATEGIES AND PROCEDURES

Strategies and procedures have been developed to facilitate the on-site implementation of the environmental policy. The mitigation measures were drawn from Orano's guidelines, the Trekkopje EMP and ESIA. They were updated and improved based on experience gained during the operation of the pilot plants. Remedial actions and monitoring are carried out by the company's environmental team who report the results biannually to MEFT. All the environmental mitigation and monitoring actions as described in the ESIA and this updated EMP will continue to be carried out in accordance with these documents.

### 4.4 COMMUNITY ENGAGEMENT

OMN has a community relations and corporate social investment programme that continues funding and supporting its community initiatives during the care and maintenance period according to the commitments outlined in the social policy (2021, see box below).

***Orano Mining Namibia recognizes that the social and economic impact of its mining operations should result in tangible and sustainable benefits to neighbouring communities. Having mined the Trekkopje deposit the company aims to leave behind a legacy of physical, human and intellectual capital to the benefit of the nation.***

Orano Mining Namibia will invest in community projects that are compliant with Orano's code of ethics and with Orano Mining's standard on community investments in four main focus areas:

- Economic development
- Access to energy and safe drinking water
- Health-related infrastructure, equipment and training
- Access to education infrastructure and training

The company will support community projects that have the potential to become self-sustainable to avoid creating dependence on the mine.

We promote active partnerships based on mutual commitment, trust and openness at local and national levels, while respecting cultural and customary practices.

Decisions on projects will be taken in consultation with our partner organisations and respond to their priority needs.

We will interact with communities in a socially responsible manner and keep them informed of new developments on the mine and plans for mine closure.

The company will comply with national and international legislation, regulations and standards (including the International Council on Mining and Metals sustainable development principles).

We recognize the limits of our community engagement with regard to political and social structures, and will identify marginalised members of the community for inclusion in development initiatives.

Our corporate social responsibility plan will be implemented to the extent possible during the care and maintenance phase, focussing on the development of small and medium enterprises to create employment in the Erongo region.

We will promote economic growth by preferentially employing local residents and local suppliers of goods and services, especially those from disadvantaged groups.

OMN will maintain internationally approved standards of employee and public health, safety and environmental protection and will continue to work closely with the Namibian Chamber of Mines and the Namibian Uranium Association to uphold the standard of mining practices in Namibia.

## 5 MITIGATION MEASURES

The social and environmental mitigation tables below outline the mitigation measures that OMN currently applies or will apply once the mine is in operation to address the environmental and social impacts during operations, care and maintenance and closure, as well as monitoring and care after closure.

**Table 2: General mitigation measures to be applied throughout the life-of-mine**

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility
1	All	Environmental management system	Legal compliance	Local regulations and Orano directives are enforced and potential modifications are anticipated. A legal register is maintained when the mine is in operation (i.e. not during care and maintenance).	HSE ENV PR 26 Environmental code of practice	QHSE Specialist
2			Risk assessment and mitigation	Significant environmental aspects and risks associated with each activity are identified, assessed and prioritized. Environmental impact assessments are carried out for new activities, risk assessments are conducted and remedial actions are identified and implemented.		
3				A consolidated environmental action plan is drawn up and progress is monitored annually.		
4				Introduce environmental sign-off on project designs with a significant environmental impact to ensure that environmental criteria are taken into account when decisions are made.		
5	Environmental awareness, internal communication	Human behaviour change		All new hires (Orano employees and contractors) attend an environmental induction to alert them to significant environmental aspects and risks associated with the mine's activities. Appropriate environmental guidelines are provided for different contractors.	HSE ENV PR 26 Environmental code of practice	QHSE Specialist, all managers
6				The environment is discussed at meetings to ensure everybody is trained in good environmental practices. Environmental issues are included in shift start talks and discussed at monthly HSE meetings.		
7				Managers at all levels carry out participatory environmental inspections as part of HSE inspections.		
8				The environmental policy, objectives and indicators are updated and explained to employees. All incidents are investigated and employees are informed of the corrective or preventive action taken. Improvement ideas and good practices are recorded and exchanged between Orano business units.		
9	External Communication	Public perception, social impact		Publish an annual environmental and social report and distribute to stakeholders. Interact with the public. Maintain complaints register and address complaints from members of the public.	HSE ENV ST 13 Community relations strategy	Communication & Community Specialist, QHSE Specialist

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility	
10		Biodiversity	Loss of biodiversity	Fauna and flora inventories are drawn up; steps are taken to protect the local <b>vegetation and wildlife</b> .	HSE ENV ST 02 Bio-diversity strategy	QHSE Specialist	
11			Loss of vegetation	Restrict removal of vegetation, leave rootstock if possible. Plants rescued from disturbed sites to be relocated to suitable sites, namely habitats where the species to be transplanted already occur naturally. Eradicate alien invasive species. Incorporate unique habitats and features into the mine layout by using them as protected islands or as components of the mine rehabilitation plan. No clearing of vegetation outside mining area, no firewood collection, rescue important species, collect seeds for use in future restoration.			
12			Loss of fauna and flora	Avoid siting excavations and infrastructure in sensitive habitats such as rocky ridges, drainage lines or unique vegetation zones.	HSE ENV PR 06 Ground disturbance permit		QHSE Specialist
13			Fauna impacts	Avoid restriction of fauna movement due to fences. Only fence hazardous areas, pit, camps, process areas and offices. Prohibit killing or injuring animals, e.g. poaching, setting of snares. Take precautions to reduce road kill (speed limits, limitations on night driving). No unnecessary disturbance of animals, preserve small mammal, reptile and bird nesting sites.	HSE ENV ST 02 Bio-diversity strategy, HSE ENV PR 09 Water strategy		QHSE Specialist
14				Avoid the presence of open water as this could attract wildlife and insects. Any leaks <b>to</b> be fixed promptly. <b>Recommendation:</b> process and water storage ponds should be fenced to keep animals out and for ponds with elevated concentrations of toxic substances, floating covers should be considered to reduce bird and insect contact with solutions.			
15	Chemical accident risks	Pollution, public health impact	A hazard study is carried out and a schedule is drawn up to implement the conclusions. HAZOP risk analyses to be carried out prior to the launch of projects or major upgrades of facilities.	HSE ENV PR 26 Environmental code of practice	Mine Manager		
16	Chemical health risks	Pollution and health impacts	The <b>Orano</b> group directives concerning asbestos, legionnaire's disease and CMR substances are enforced.		QHSE Specialist		
17	Hazardous materials risks	Chemical pollution of soil and water	Chemicals to be stored in closed or bunded areas. Periodic checks for leaks from storage tanks or containers to be carried out.	HSE ENV ST 06 Hazardous materials strategy	Mine Manager		
18			Pollution control measures include regular inspection, data evaluation, trend analysis and continuous improvement <b>measures</b> .	<b>HSE ENV ST 06 Haz. materials strategy</b>	QHSE Specialist		
19			Hydrocarbon pollution of soil and water	Store hydrocarbons in bunded areas, check tanks for leaks, install oil separation systems in wash bays. Vehicles to be regularly serviced to reduce oil leaks, drip trays must be used when vehicles are repaired in the field. Used solvents, oils and grease to be kept in sealed containers and recycled or disposed of at hazardous waste site. Contain and clean up hydrocarbon spills, train <b>minimum of 10</b> employees in spill response, emergency spill kits to be kept at each site where hydrocarbons are used.	HSE ENV ST 06 Hazardous materials strategy, HSE ENV PR 11 Hazardous substances, HSE ENV PR 10 Diesel/oil spill procedure	Mine Manager	

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility	
20				Remove contaminated soil to an approved facility or treat on site by bioremediation.	HSE ENV PR 27 Bioremediation procedure	QHSE Specialist	
21				Provide bunding at fuel storage and transfer sites large enough to contain 110% of the volume of the largest tank. The tanks must stand on a concrete slab.	HSE ENV ST 06 Hazardous materials strategy	Mine Manager	
22		Radiation risks	Public health impact from radiation	Prepare a radiological public health risk assessment, including cumulative effects of other mines, and determine rehabilitation requirements of the leached ore (backfill) and any remaining stockpiles. Should elevated radon emanations pose a risk to the public emplace a compacted soil covering of sufficient thickness to allow radon and its progeny to decay before reaching the surface.	Closure plan, radiation management plan (RMP)	QHSE Specialist	
23				Limit the radiation exposure of occupationally exposed workers and members of the public on the mine plant and waste areas to as low as reasonably achievable. Ensure that the requirements of the RMP are implemented and exposures are kept below the dose limits set by the NRPA.	RMP	QHSE Specialist	
24		Soil and groundwater	Soil and groundwater pollution	Establish baseline conditions before exploration or production work begins. If applicable, assess pre-existing pollution prior to acquisition. Compile a plan to reduce the risk of pollution and potential impacts (= this EMP).	HSE ENV RE 59 Soil characterisation report, HSE ENV RE 70 Water baseline report	QHSE Specialist	
25			Soil pollution	Train employees in spill response (every three years) and provide clean-up material such as spill kits.	HSE ENV PR 10 Diesel/oil spill response procedure, RMP		
26			Groundwater pollution		Carry out regular groundwater quality monitoring to assess the mine's impact.	HSE ENV PR 21 Water quality monitoring procedure	QHSE Specialist
27		Establish a network of monitoring boreholes and carry out regular water quality sampling. Install boreholes around the heap leach pads and monitor groundwater for any accidental seepage due to spills or damaged liners.					
28		Pollution control measures should include proper storage and bunding of areas that contain chemicals and oils. Regular inspection and maintenance of containers, bunding, storage tanks, and oil separation systems must be undertaken.			HSE ENV ST 06 Hazardous materials strategy		
29				A risk assessment should be completed to identify potential leakage pathways. From this a monitoring and emergency response plan should be developed.	HSE ENV ST 09 Water strategy		
30	All	Monitoring	Pollution	Set up a plan for radiological, chemical and biological monitoring of the air, water, soil and food chain. <ul style="list-style-type: none"> <li>• Radiological: Env. TLDs, alpha dosimeters, personal dosimeters (TLDs)</li> <li>• Air quality: climate (gas and dust emissions only in operation)</li> <li>• Water: groundwater, potable water, sewage quality, water consumption</li> <li>• Soil (only during mine operation): radionuclide and heavy metal deposition from dust fallout</li> </ul>	HSE ENV PR 26 Environmental code of practice	QHSE Specialist	

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility
				<ul style="list-style-type: none"> <li>Food chain (only during mine operation): radionuclides in vegetation and wildlife (if available)</li> </ul>		
31		Closure planning	Long-term impacts, land use	Compile a decommissioning plan for exploration and production sites, provide sufficient budget for closure and aftercare. Consult stakeholders about future land use options and expectations. Consider retrenchment plan and sustainable development issues.	HSE ENV ST 03 Closure strategy	QHSE Specialist
32		Resource use and emissions	Water and energy consumption, air pollution	During mine operation plan to reduce the consumption of non-renewable resources. Measure and publish consumption and emission data. Set targets to reduce water and fossil energy use, and GHG (CO <sub>2</sub> , SO <sub>2</sub> , NO <sub>x</sub> , VOC) emissions.	HSE ENV PR 26 Environmental code of practice	QHSE Specialist
33				Ensure that the 'reduce, reuse and recycle' philosophy is applied to minimise wastage of limited water resources. All options for water demand reduction should be investigated, e.g. if possible the heap leach wash water should be recycled as this will reduce net water consumption.	HSE ENV ST 09 Water strategy	QHSE Specialist
34		Waste management	Waste reduction	Wastes generated are identified and quantified, <b>employees are trained in waste separation</b> . During mine operation multi-annual targets are set for reducing wastes at source and optimizing recycling. The waste hierarchy is applied in order of preference i.e. waste avoidance, waste reuse, waste recycling or reclamation, waste treatment and waste disposal.	HSE ENV ST 11 Waste management strategy	QHSE Specialist
35				Except for construction rubble <b>and ashes of burnt non-hazardous domestic waste</b> , waste may not be buried on site but must be removed to an approved <b>recycling or</b> disposal site	HSE ENV PR 19 Waste management procedure	
36		Innovation	Improved environmental performance	Develop advanced technologies for the treatment of waste and effluent, e.g. reuse heap leach effluent in a closed loop to minimize effluent discharge. Rinse spent ore to recover reagents and reduce environmental impact. Improve modelling in terms of long-term contaminant behaviour and transport of contaminants from backfilled tailings.	HSE ENV ST 05 Environmental strategy	QHSE Specialist
37		Visual impact management	Visual intrusion, <b>light pollution</b>	Ensure that structures are sited close to each other, located away from areas that are visually exposed, set as low as possible and kept below the height restriction of 35 m above mean ground level.	HSE ENV ST 15 Visual impact management strategy	Managing Director, Mine Manager
38				Paint colours should be muted earth tones or in the case of large surfaces such as roofs and storage tanks medium grey. Bright colours should only be used for safety markings. Keep outside paint jobs in good condition.	HSE ENV ST 15 Visual impact management strategy	
39				Height of dumps and pit backfill should not exceed <b>35</b> metres. The slope angles should be flattened at mine closure to less than 18 degrees.	HSE ENV ST 14 Mineral waste strategy	
40				Light pollution should be avoided by making use of directional lighting directed to work areas, avoiding high mast lighting and provision of shutters to limit light scatter. Use orange light to limit attraction of night-flying insects.	HSE ENV ST 15 Visual impact management strategy	
41				<b>Occasionally</b> undertake external monitoring of the visual impact as part of the Environmental Control Officer's audit (external EMP audit).	HSE ENV ST 15 Visual impact strategy	QHSE Specialist

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility
42		Archaeological management	Impact on historical sites	Provide guidelines to all contractors and personnel specifying restrictions associated with the old workings of the Annaberg Tin Mine and other heritage sites. In the event that any historical areas need to be disturbed, a permit must be obtained from NHC prior to any disturbance.	HSE ENV PR 07 Historical sites	QHSE Specialist
43		Traffic management	Increased traffic on the B2 and gravel roads	Ensure that all drivers are competent, licensed and take care when overtaking and keeping to the speed limit. On-going driver training should be offered to employees and contractors. All vehicles should travel with their headlights on and no driver may drive under the influence. Ensure adequate communication systems and safety provisions in the event of breakdown or accidents.	HSE SAF PR 18 Vehicles and driving	QHSE Specialist
44	Deterioration of gravel roads		Ensure that all gravel roads are well maintained, so that drivers do not take short cuts and keep to established gravel roads. Keep the number of new roads to a minimum. For new roads adequate provision of signage, delineation should be made. Any road no longer in use should be rehabilitated.	HSE ENV PR 13 Road construction and HSE ENV PR 14 Road material selection procedures	Engineering Manager	
45	Impact on fauna and flora		Ensure that all drivers keep to the speed limit to prevent excess dust generation. Along main access routes the limit should be 70 km/h whilst along haul roads the limit should be 50 km/h. <b>Depending on traffic density access routes should be watered to limit dust generation.</b> Any new access roads should avoid sensitive habitats; all endemic species should be removed and relocated.	HSE SAF PR 18 Vehicles and driving, HSE ENV PR 02 Dust control, HSE ENV PR 06 Ground disturbance permit	Engineering Manager, QHSE Specialist	

**Table 3: Activity-specific mitigation measures to be applied during operations**

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility
1	Mining and construction	Land surface disturbance	Habitat loss	Apply strict access control. Have manned security checkpoints on the main entry roads (near Arandis and on the pipeline road).	HSE ENV PR 26 Code of practice	Mine Manager
2				Minimise mining footprint through careful planning and scheduling. Minimise impact of access roads, borrow pits and turning points. Only remove or disturb soil and vegetation in the dedicated mining area, restrict substrate disruption to the minimum. Avoid placing waste rock dumps, stockpiles and associated infrastructure in sensitive areas such as in or close to drainage lines, rocky ridges or lichen fields and preferably place heaps on areas previously cleared.	HSE ENV PR 06 Ground disturbance permit procedure	Mining Manager
3				Backfilling of pits and restoration of surface should be undertaken on a progressive basis to keep pace with the rate of advance of mining (refer to closure phase). Backfilling slopes should achieve a maximum gradient of not more than 18 degrees. Backfilled pits, waste rock dumps and disturbed areas must be stabilised to allow re-vegetation.	HSE ENV ST 03 Closure strategy	Mining Manager, QHSE Specialist
4			Loss of soil fertility	Strip top ±10 cm of soil, stockpiles should be kept to a maximum height of 2 m and clearly demarcated. Use for rehabilitation as soon as possible, avoid re-handling. Ensure that subsoil with high salinity and sodium adsorption ratio is not mixed with topsoil as this may affect plant growth. If soil is not used within a year of stripping, let the stockpiles re-seed naturally to maintain microbiological processes. Rehabilitated soil should be watered to assist with germination and reestablishment of vegetation.	HSE ENV PR 15 Topsoil management procedure	Mining Manager, QHSE Specialist
5			Soil compaction	Control off-road driving; avoid one-off movements across undisturbed surfaces.	HSE ENV PR 09 Off road driving procedure	QHSE Specialist
6			Soil erosion	Construct bunding around pits to control water erosion.	Mining procedure (no number)	Mining Manager
7		Biodiversity loss	Loss of vegetation (see ID11)	Restrict removal of vegetation, leave rootstock if possible. Plants rescued from disturbed sites to be relocated to suitable sites, namely habitats where the species to be transplanted already occur naturally. Eradicate alien invasive species. Incorporate unique habitats and features into the mine layout by using them as protected islands or as components of the mine rehabilitation plan. No clearing of vegetation outside mining area, no firewood collection, rescue important species, collect seeds for use in future restoration.	HSE ENV ST 02 Biodiversity strategy	QHSE Specialist
8			Loss of fauna (see ID12)	Avoid siting excavations and infrastructure in sensitive habitats such as rocky ridges, drainage lines or unique vegetation zones.	HSE ENV PR 06 Ground disturbance permit	QHSE Specialist
9			Avoid restriction of fauna movement due to fences. Only fence hazardous areas, pit, camps, process areas and offices. Prohibit killing or injuring animals, e.g.	HSE ENV ST 02 Biodiversity strate-	QHSE Specialist	



ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility
				poaching, setting of snares. Take precautions to reduce road kill (speed limits, limitations on night driving). No unnecessary disturbance of animals, preserve small mammal, reptile and bird nesting sites.	gy	
10		Air quality – dust	Soil, flora and fauna impacts	Draw up a project-wide dust control plan.	HSE ENV ST 01 Air quality strategy	Managing Director
11				Investigate use of environment-friendly surfactants. Minimise fugitive dust emission from mining activities (spray water on roads, control speeds).	HSE ENV PR 02 Dust control	Mining Manager
12				Restrict vehicular access to temporary surfaces during periods of inactivity.	Mining procedure (no number)	
13	<b>Drilling and blasting</b>	Noise and vibration generated by blasting	Biodiversity loss	Determine if fauna and flora on site will be affected.	HSE ENV ST 02 Biodiversity strategy	QHSE Specialist
14			Public nuisance	Determine if neighbouring communities will be affected. Ensure that appropriate stemming and adequate blast design is used to limit ground vibration. Blast during daytime.	HSE ENV ST 07 Noise and vibration strategy	QHSE Specialist
15		Air quality – dust	Soil, flora and fauna impacts	Drill rigs to be fitted with dust extraction systems or dust cowls. Need to avoid over-blasting and use low charge factors.	HSE ENV PR 02 Dust control procedure	Mining Manager
16		Occupational health	Occupational health – noise	Ensure that employees, contractors and visitors wear the appropriate PPE. Ensure equipment is properly maintained and fitted with the necessary silencers and mufflers.	Mining procedure (no number)	Mining Manager
17		Occupational health – radiation	Use dust extraction systems, and good dust control to keep exposure to radon and LLRD ALARA. Ensure that drill crews wear PPE and are monitored.	RMP	QHSE Specialist	
18	<b>Loading and hauling</b>	Air quality – dust	Soil, flora and fauna impacts	Minimise fugitive dust emission from hauling and loading activities (spray water on roads, control speeds). Use hard, nonfriable materials for haul roads and investigate the use of environment-friendly surfactants. Haul truck bins must be designed to minimise spillage, maintain sufficient freeboard when loading. Minimise the height that material will free fall during loading and dumping and enclosing where possible transfer points and storage facilities. Use water sprays on muck piles and either dry collectors or wet scrubbers at bulk transfer points.	HSE ENV PR 02 Dust control	Mining Manager, Metallurgy Manager
19		Air quality – gas emissions	Air pollution	Monitor gas emissions to assess impact. Ensure diesel engines are well maintained.	HSE ENV PR 25 Environmental monitoring	QHSE Specialist
20	<b>Crushing, screening and agglomeration</b>	Air quality – dust	Soil, flora and fauna impacts	Ensure good dust management and housekeeping to minimise the accumulation of dust piles. Collect dust at emission sources through the use of dry collectors or wet scrubbers at bulk transfer points.	HSE ENV PR 02 Dust control procedure	Metallurgy Manager
21	<b>Conveying</b>	Air quality – dust	Soil, flora and fauna impacts	Ensure that dust suppression/extraction equipment is fitted at all material transfer points between crushers and heap leach process. Where necessary conveyors will be covered (rising sections).	HSE ENV PR 02 Dust control procedure	Metallurgy Manager

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility
22	Heap leaching	Water - groundwater quality	Pollution of groundwater	Develop a comprehensive water management and monitoring plan for the heap leach pads, inspect pads for early seepage detection, and repair damaged liners.	HSE ENV PR 21 Water quality management	Met Manager, QHSE Specialist
23				Before the start of operation, establish monitoring boreholes around heap leach pads, determine water quality regularly.	HSE ENV PR 21 Water quality management	
24	Yellowcake production	Occupational health	Occupational health – radiation	Limit the radiation exposure of workers to ALARA in accordance with the RMP (use radiation detection equipment and individual monitors, impose strict personal hygiene standards for workers handling uranium oxide concentrate).	RMP	Metallurgy Manager, QHSE Specialist
25		Transport – product spill	Public health	Safety signage to be displayed and all IAEA requirements regarding transport of yellowcake to be met, in accordance with procedures outlined in the RMP.	RMP	
26	Tailings backfilling	Water – groundwater quality	Pollution of groundwater	Determine groundwater protection requirements, e.g. lining of the pit, runoff control and capping of the backfill.	Closure plan	QHSE Specialist
27				Regular monitoring of levels and geochemical analysis of groundwater around the pit and down gradient must be undertaken to determine the impact of tailings backfilling on groundwater.	HSE ENV PR 21 Water quality management	
28		Land surface – soil	Soil pollution	Provide runoff control on backfilled tailings or capping to ensure that soil in downstream area is not degraded.	Closure plan	

**Table 4: Mitigation measures relating to social activities to be applied throughout the life-of-mine**

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility
1	<b>Employment and re-trenchment</b>	Local employment	Benefits for local communities	Abide by the conditions stipulated in the Labour Act (No. 6 of 1992) and the Affirmative Action (Employment) Act No. 29 of 1998.	HR PO 16 Employment equity policy	HR Manager
2			High rate of unemployment	Develop a recruitment strategy that prioritises employment from communities in Arandis and the #Gaingu Conservancy, and ensure equitable employment opportunities for marginalised groups.	HR PO 01 Employment policy	
3			Inward migration of job seekers	Advertise recruitment processes, avoid use of casual labour, advise local authorities of employment needs and get their help in identifying local candidates.		
4			Impacts of retrenchment	Develop a retrenchment policy and strategy that deals with economic, psychological and social impacts. Provide counselling services if possible three months before departure, assess training needs and provide voluntary after-hours training programmes in appropriate fields.	HR PO 17 Retrenchment policy	
5	<b>Local economic development</b>	Sustainability of local economy	Benefits for local communities	Implement mechanisms to promote local procurement, use of local service providers and assist where capacity is lacking, promote the incorporation of women into the local economy and facilitate funding for SMEs.	HSE ENV ST 13 Community relations strategy	Community & Communication Specialist
6			Dependence on mining	Together with local authorities plan and assist in the development of sustainable economic development that is independent of the mining industry.		
7	<b>Education and training</b>	Education and skills development	School capacities overloaded	Assist education authorities to upgrade the capacity of schools at the coast and encourage cooperation between different mines to manage the shortage of classrooms.		
8			Capacity and technical skills	Provide <b>funding/scholarships for tertiary training at Namibian institutions</b> . Implement programmes to promote education and skills development and make available to all employees.	HR PO 23 Human resources development policy	HR Manager
9			Training of local communities	Promote the vision of Arandis to become a centre of education excellence, support NIMT, schools and other education facilities in other towns within the Orano designated area.	HSE ENV ST 13 Community relations strategy	Community & Communication Specialist
10	<b>Accommodation</b>	Housing for workers	Lack of suitable housing	Promote home ownership and structure employee benefits such that they can afford decent housing (housing benefits to be added at start of operation)	HR Remuneration policy	HR Manager
11	<b>Health and welfare</b>	Health and radiation awareness	Employee wellness	Implement a comprehensive employee wellness programme, including HIV/AIDS and TB awareness and testing, wellness initiatives, maternal health awareness. <b>Minimise the incidence rates of industrial lung disease (incl. pneumoconiosis), industrial lung and other cancers, renal damage, tuberculosis and dermatitis</b>	HR PO 20 Employee wellness policy, <b>HSE SAF PO 01 HSRP policy</b>	
12			Radiation fears	Work together with other mines and interested bodies i.e. Rössing Foundation, Chamber of Mines, Namibian Uranium Institute, Ministry of Health and Social Services to <b>increase</b> public awareness of radiation and uranium.	<b>Namibian Uranium Institute programmes</b>	

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility
13	Economic development	Support for local authorities	Upgrading of local services	Support improved service delivery in coastal towns and specifically at Arandis and sustainable economic development projects in consultation with the Arandis town council.	HSE ENV ST 13 Community relations strategy	Community & Communication Specialist
14		Create employment and reduce poverty in #Gaingu Conservancy	Loss of access and grazing	Equitable recompense not based on monetary compensation but rather on needs should be negotiated with the !Oe #Gan Traditional Authority. Assist in funding and supporting the implementation of measures outlined in the economic development plan for the #Gaingu Conservancy.		
15		Create tourism opportunities in #Gaingu Conservancy	No alternative sources of income	Assist and support the #Gaingu Conservancy to implement its conservancy management plan, provide training in aspects of environmental stewardship and management, assist with game counting and anti-poaching drives (if requested), facilitate future inclusion of the former Annaberg tin mine in a proposed tourist route.		
16	Closure planning	Ensure sustainability on closure	Economic decline of local communities	Complete a closure plan that considers the long-term sustainability of communities. Plan should include KPIs for monitoring, support alternative development initiatives, collaborate with other mining companies and authorities to ensure that activities are aligned, and support sustainability and skill retention.	Closure plan	QHSE Specialist, Community & Communication Specialist
17	Community and stakeholder relations	Promote transparency and build relationships	Lack of trust	Implement the stakeholder engagement strategy, monitor relations with stakeholders and partnerships; keep regular contact with all groups. Communications can be in the form of personal conversations with key stakeholders, reports, open days, newsletters and other relevant media.	HSE ENV ST 13 Community Relations Strategy	Community & Communication Specialist
18			Stakeholder concerns	Keep a register of public complaints, address and follow up complaints by responding promptly to members of the public. The register is kept at the Orano office in Swakopmund under the authority of the Community & Communication Specialist.		

**Table 5: Mitigation measures to be applied during mine closure**

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility
0	General objectives	Future land use	Loss of use options if structures remain	Create stable landforms that blend in the natural environment and demolish all infrastructure not required by future landholder(s)	Closure plan	QHSE Specialist
		Infrastructure use	Optimal use of resources	Prefer third-party use to dismantling so that suitable structures can benefit future land owners, identify users of infrastructure that can remain after closure, e.g. power lines, roads, Erongo desalination plant, Arandis railway siding		
1	Infrastructure removal	Land surface – disturbance	Habitat loss	All infrastructure will be removed, unless an alternative use for it has been identified and agreed with the land owners and future user(s).	Closure plan	
2		Air quality – dust	Soil, flora and fauna impacts	Dust control measures must be applied during demolition and restoration work.	HSE ENV PR 02 Dust control procedure	
3		Non-hazardous waste management	Pollution	Steel and reusable non-hazardous material to be salvaged and sold. Non-hazardous waste that cannot be recycled to be taken to municipal landfills. Concrete foundations >1 m below the ground may be left in place, all others to be removed. Pipes buried below 0.5 m may remain. Building rubble to be backfilled into excavations to restore the original site profile.	Closure plan	
4		Hazardous waste management	Pollution	Demolition sites to be inspected for hydrocarbons and chemicals. Any hazardous materials and chemicals will be either returned to suppliers or taken to the hazardous waste facility in Walvis Bay. Remediate all soil pollution.	HSE ENV PR 11 Hazardous substances procedure	
5		Radioactive waste management	Health – radiation	All demolition sites to be inspected and cleared for radioactivity. Radioactive materials will be disposed of in the open pit or granite quarry. The pit/quarry will be prepared as a low-level radioactive waste site by lining and/or capping.	Closure plan	
6	Site rehabilitation	Land surface – disturbance	Habitat loss	Shape all areas to resemble the original landscape as closely as possible, including drainage lines, and restore ecological function. Use stockpiled topsoil.		
7		Land surface – pollution	Long-term contamination	Remediate all soil pollution, remove or control residual hazardous and radioactive waste materials. Compacted contaminated areas must be ripped and contaminated soil removed and treated or removed to the <b>hazardous waste site</b> .		
8		Soils	Loss of flora and fauna	<b>Adapt biodiversity restoration measures to sensitivity of habitat and develop measures to facilitate natural recovery. Clean up all remaining pollution, remove treated soil from the bioremediation site. Replace stored topsoil on disturbed land or provide another suitable substrate for plant growth where needed.</b> Treat surface for reseeded, in small areas of lightly compacted soil rake before seeding and maintain optimal moisture to ensure germination. Apply stored seeds of indigenous vegetation, <b>investigate propagation of endemic shrubs. Restoration of plant life will enable fauna to return to disturbed sites.</b>		
9		Archaeology	Loss of heritage	During rehabilitation work, abide by restrictions associated with the Annaberg tin mine. Public access from the road through the workings should be prevented.		

ID	Activity	Aspect	Impact	Mitigation	Procedure	Responsibility
10	Pits and pads rehabilitation	Land surface – disturbance	Visual intrusion	Adjust the mining plan to favour backfilling of mineral waste into the open pit. Waste rock will be returned to pit except for a few external waste rock dumps. Height of pit backfill and dumps will be less than 35 m above surface and they will be profiled into stable forms to minimise erosion. Slope angles should be less than 18 degrees with a convex crest and concave slope.		
11		Mineral waste management	Public health impact – radiation	Decontaminate radioactive structures if possible or dispose at an approved hazardous waste facility. Prevent health impacts from radiation or pollution to people living on and around the mining area. Monitor radiological groundwater and air quality during the aftercare phase.	Closure plan	QHSE Specialist
12		Surface and groundwater	Formation of pit lakes	Pits should be backfilled and shaped to prevent water accumulation (if pit lakes develop after rain they are likely to disappear due to high evaporation rates).		
	Diversion of surface water runoff		Restore natural water drainage conditions if possible, or divert rivers around structures that will remain in place.			
13	Roads and servitudes	Land surface – disturbance	Soil, flora and fauna impacts	Water and power supply lines (except for NamPower lines) must be removed and the disturbed areas rehabilitated.		
14				Roads, except for those agreed to remain, must be ripped and re-contoured and the disturbed areas rehabilitated.		
15	Socio-economic	Stakeholder engagement	Loss of employment	Mitigate the impact of retrenchment and upgrade employees' skills so they can secure alternative employment. Assess retrenchment impacts and alternative livelihood options. Early engagement with workforce, labour union and local authorities to determine the most appropriate management measures.		
16			Acceptance of closure plan	Interact with communities during development of the mine closure plan to decide on achievable and mutually beneficial closure criteria.		
17			Sustainability of community projects	Ensure that community projects in the areas of health, education, culture and socio-economic development have become self-sustainable at mine closure.		
18	Aftercare	Land surface and biodiversity	Effective restoration	Rehabilitated areas to be monitored to confirm that they are self-sustaining. Monitor site stability and effectiveness of restoration measures, as well as ecological functioning over several years after closure.		
19	Relinquishment	Land use	Restore beneficial use	Make the site safe for public use and hand back to the original owners with the fewest possible restrictions on the use of the land.		

# Appendix A – Environmental Clearance Certificate

ECC – 00391

Serial: xi881a391



**REPUBLIC OF NAMIBIA**

**MINISTRY OF ENVIRONMENT AND TOURISM**

OFFICE OF THE ENVIRONMENTAL COMMISSIONER

## **ENVIRONMENTAL CLEARANCE CERTIFICATE**

**ISSUED**

In accordance with Section 37(2) of the Environmental  
Management Act (Act No. 7 of 2007)

**TO**

**Orano Mining Namibia (Pty) Ltd**  
**P.O. Box 585 Swakopmund, 25 Mandume Ya Ndemufayo Street.**

**TO UNDERTAKE THE FOLLOWING LISTED ACTIVITY**

**Mining Operation (Large+ Low Grade Uranium Resources) on Mining  
Licence 151, Erongo Region.**

  
DEPUTY ENVIRONMENTAL COMMISSIONER



Issued on the date: **2019-12-05**

Expires on this date: **2022-12-05**

**(See conditions printed over leaf)**

This certificate is printed without erasures or alterations



**CONDITIONS OF APPROVAL**

1. This environmental clearance is valid for a period of 3 (three) years, from the date of issue unless withdrawn by this office
2. This certificate does not in any way hold the Ministry of Environment and Tourism accountable for misleading information, nor any adverse effects that may arise from these activities. Instead, full accountability rests with the proponent and its consultants
3. This Ministry reserves the right to attach further legislative and regulatory conditions during the operational phase of the project
- 4.





Orano Mining Namibia

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Swakopmund