Ministry of Mines and Energy

Strategic Environmental Management Plan (SEMP) for the Central Namib Uranium Province 2017 Annual Report

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Geological Survey of Namibia

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EXECUTIVE SUMMARY

The Strategic Environmental Management Plan (SEMP) for the Namibian uranium province is a public-private collaborative initiative housed within the Geological Survey of Namibia, Ministry of Mines and Energy. The SEMP is an over-arching framework and roadmap to address the cumulative impacts of existing and potential developments, within which individual projects have to be planned and implemented. Annual SEMP reports measure the performance around twelve Environmental Quality Objectives (EQOs) that show the extent to which uranium mining is impacting the central Namib. Each EQO articulates specific goals and targets that are monitored by a set of key indicators.

Figure 1 shows the EQO performance trend since 2011. The number of indicators that were **MET** and those that were **NOT MET** has increased in 2017 compared to 2016, while there were fewer indicators **IN PROGRESS** or **NOT APPLICABLE**. This change was attributable to a more stringent assessment approach that tried to avoid rating an indicator **IN PROGRESS** when the situation was unclear or no real progress could be shown. The persistent relatively high number of outstanding issues suggests that more resources will be required if the desired outcome of the SEMP is to be achieved.

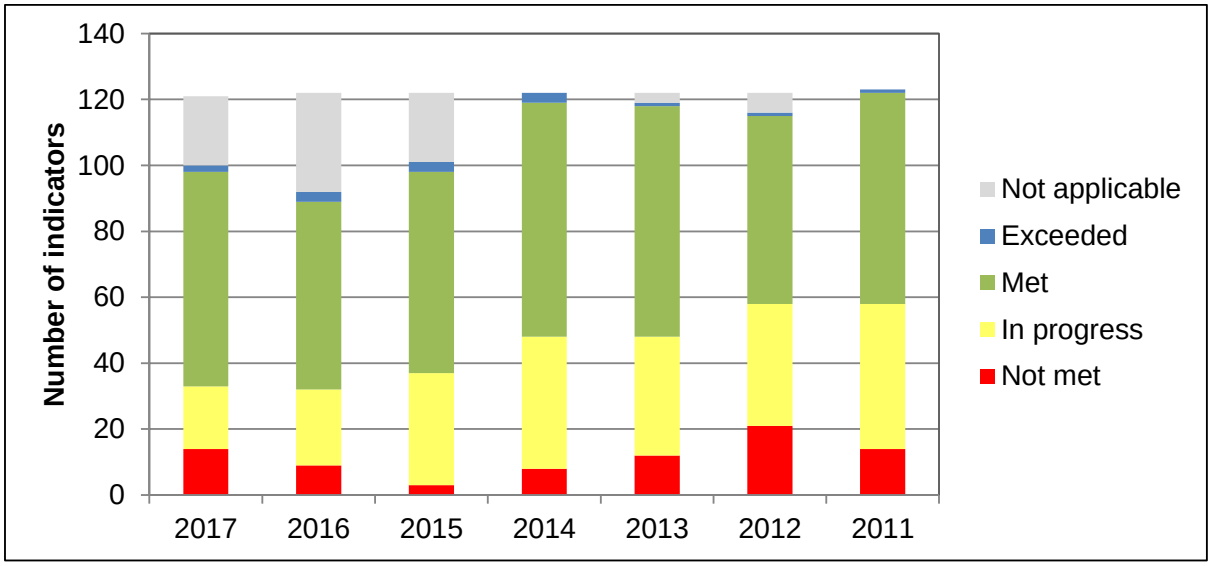

Figure 1: EQO Performance Trends over Time

The results for the various EQOs in 2017 can be summarised as follows (Figure 2):

- The Socioeconomic Development (EQO 1), Employment (EQO 2) and Air Quality (EQO 6) objectives and the two applicable indicators in Heritage (EQO 11) were all **MET**.
- The objectives for Water (EQO 4) and Mine Closure (EQO 12) were mostly **MET** with a small percentage **IN PROGRESS**.
- Mixed results ranging from **MET** to **NOT MET** were obtained in the following EQOs: Infrastructure (EQO 3), Effect on Tourism (EQO 7), Ecological Integrity (EQO 8) and Governance (EQO 10).
- In Health (EQO 6) and Education (EQO 9) the number of indicators **NOT MET** or **IN PROGRESS** was higher than the ones that were **MET**.
- Other indicators that were **NOT MET** relate to the availability of safety of the B2 road in EQO 3 and the protection of sensitive areas in EQOs 7 and 8, as well as the implementation of biodiversity offsets in EQO 8. One EQO 10 indicator was **NOT MET** because of possible corruption in the allocation of a mining licence.

- Two indicators were **EXCEEDED**, one in EQO 3 concerning Namport's infrastructure and one in EQO 7 regarding tourists' expectations of their visual experience in the Central Namib.

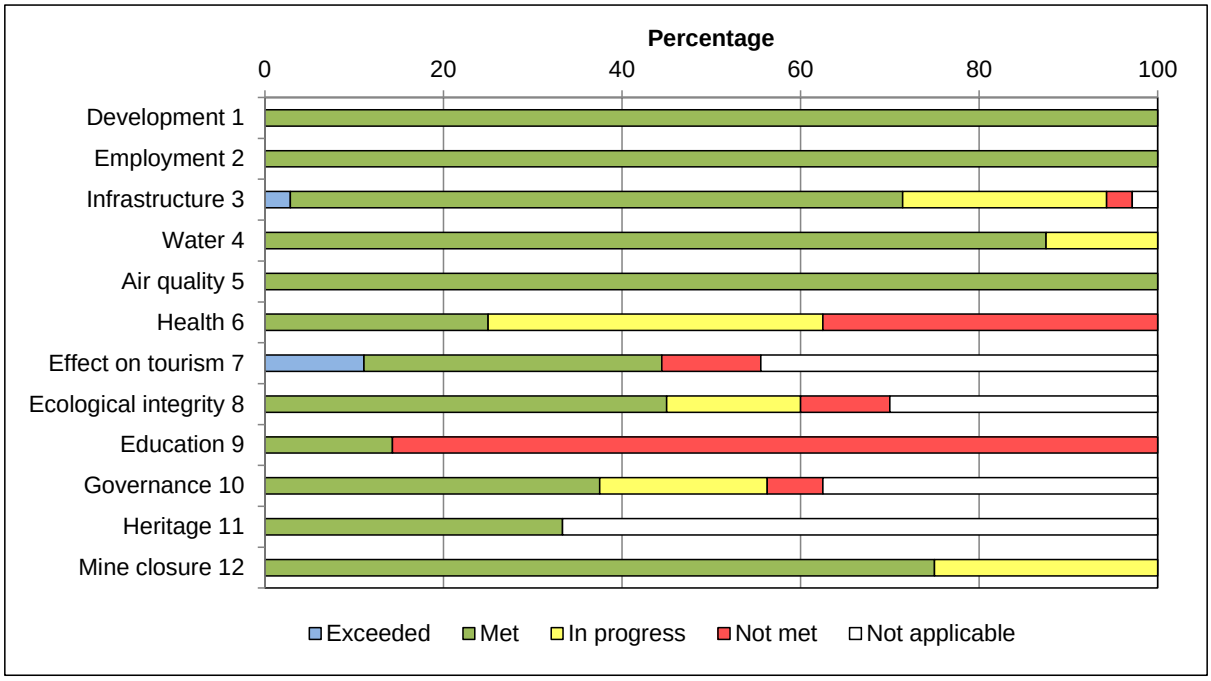

Figure 2: EQO Performance in 2017

In view of the cyclical nature of commodity markets it is expected that the demand for uranium will increase in future. The implementation of the EQO targets remains critical to ensure that the region is well positioned for future uranium mining projects. The most important actions to address the shortcomings that have been identified in this report are summarised in Table 1.

Table 1: High-level Actions to Achieve SEMP Compliance

EQO 3: Traffic volume on the B2 has increased so that the road has become unsafe (Roads Authority)	• Upgrade the road to double lanes or create passing lanes at least up to Arandis
EQO 3: Optimum use of rail infrastructure (TransNamib)	• Upgrade the railway line so that bulk freight (e.g. fuel) can be shifted from the road
EQO 4: Continuous availability of desalinated water to meet the mines' demand (NUA/Orano)	• Upgrade the Erongo desalination plant to be able to keep operating during sulphur outbreaks
EQO 6: Number of healthcare professionals and facilities (MHSS)	• Employ the number of healthcare professionals identified in the SEA, add or enlarge healthcare facilities
EQO 8: Implementation of biodiversity offsets (MET, NUA)	• MET to create enabling legislation for the lasting protection of offsets • Mines to offset damage to important biodiversity areas
EQO 9: Improvement of school performance in the region (MEAC)	• Improve teacher to learner ratio and performance in Grade 10 and 12 exams
EQO 12: Lack of mine closure regulations (MME)	• Update Minerals Act and regulations for mine closure

The SEMP is a living document that has to be amended to keep up with development. Some goals, targets and indicators have been changed in this SEMP report to make the wording clearer or more appropriate. It has become clear over the years that many indicators were formulated under the assumption that the "uranium rush" that triggered the SEA would lead to the development of quite a few new mines. The current mining scenario, which closely resembles the base case, was not foreseen in the SEA. There are only two operating mines, Rössing Uranium and Husab Mine, while Langer Heinrich Uranium was mothballed in 2018. All the other projects are still awaiting improved market conditions.

Seeing that the uranium rush was revealed as a short-lived phenomenon, the impact on the environment and the demand for social services in the Erongo Region will evidently not continue rising as a result of uranium mining. The SEMP Steering Committee has therefore raised the question whether it was worthwhile to keep on evaluating all indicators on an annual basis. It was suggested that "slow-moving" EQOs like infrastructure, health and education could be assessed every second year. Issues of public concern such as economic development, employment, tourism and ecological impact, as well as air and water quality would still be monitored and updated annually.

This would maintain the function of the SEMP as a long-term monitoring and decision-making tool through which potential impacts are highlighted so that measures can be introduced to avoid unnecessary impacts or mitigate unavoidable impacts. A continuing aim of the SEMP process is to increase the commitment of key government institutions, the uranium industry and NGOs to undertake whatever actions will take the Erongo Region towards the desired future state where communities and industry are able to co-exist in harmony.

In conclusion, it is worth mentioning that the SEMP Office compiled a brochure in 2018 to inform the public and stakeholders such as government and parastatal institutions about the objectives of the SEMP and the importance of their contributions.

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ABBREVIATIONS

AA	Affirmative Action
BMR	Bannerman Mining Resources Namibia (Pty) Limited
BH	Borehole
BMC	Basin Management Committee
CoM	Chamber of Mines
DWAF	Department of Water Affairs and Forestry
DWSSC	Directorate Water Supply Sanitation Co-ordination, DWAF
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPL	Exclusive Prospecting Licence
EQO	Environmental Quality Objective of the SEMP
GIS	Geographical Information System
GRN	Government of the Republic of Namibia
GRTC	Gobabeb Research and Training Centre
GSN	Geological Survey of Namibia
IAEA	International Atomic Energy Agency
ISO	International Standards Organisation
IWRM	Integrated Water Resources Management
LHU	Langer Heinrich Uranium (Pty) Limited
m	Metre
m^3	Cubic Metre (1,000 litres)
$mg/m^2/day$	Micrograms per Square Metre per Day
$\mu g/m^3$	Micrograms per Cubic Metre
Mm^3/a	Million Cubic Metres per Annum (year)
m/s	Metres per Second
mSv/a	Millisieverts per Annum
MAWF	Ministry of Agriculture, Water Affairs and Forestry
MHSS	Ministry of Health and Social Services
MLIREC	Ministry of Labour, Industrial Relations and Employment Creation
MME	Ministry of Mines and Energy
MEAC	Ministry of Education, Arts and Culture
MoF	Ministry of Finance
N$	Namibian Dollars
NamWater	Namibia Water Corporation (Pty) Ltd
NACOMA	Namibian Coast Conservation and Management
NBSAP2	National Biodiversity Strategy and Action Plan 2
NERMU	Namib Ecological Restoration and Monitoring Unit
NIMT	Namibian Institute of Mining and Technology
No.	Number
NRPA	National Radiation Protection Authority
NSA	National Statistics Agency
NTA	National Training Authority

NUA	Namibian Uranium Association
NUST	National University of Science and Technology
Pers. comm.	Personal Communication (interview or e-mail)
PM_{10}	Inhalable dust with particles smaller than 10 micrometres
RMR	Reptile Mineral Resources and Exploration (Pty) Limited
RUL	Rössing Uranium (Pty) Limited
SA NDCR	South African National Dust Control Regulations
SANS	South African National Standard
SEA	Strategic Environmental Assessment
SEMP	Strategic Environmental Management Plan
SU	Swakop Uranium (Pty) Limited
UNAM	University of Namibia
VET Levy	Vocational Education and Training Levy
WHO	World Health Organisation

Abbreviations used in Chemical and Radiological Analyses

As	Arsenic
Bq/m^3	Becquerel per Cubic Metre
Ca	Calcium
$CaCO_3$	Calcium Carbonate (limestone)
Cd	Cadmium
cfu/mL	Colony-forming units per millilitre
Cl	Chloride
F	Fluoride
Fe	Iron
Mg	Magnesium
mg/L	Milligrams per litre (also written as mg/l)
Mn	Manganese
Na	Sodium
NO_3	Nitrate
Pb	Lead
SO_4	Sulphate
TDS	Total Dissolved Solids (a measure of salinity)
U	Uranium
U_3O_8	Uranium oxide, the form that is usually traded on the market

SEMP BACKGROUND

A Strategic Environmental Assessment (SEA) was undertaken in response to a "uranium rush" that occurred when the spot market price started rising in 2005 and reached over US$120 per pound in 2007. An unprecedented wave of exclusive prospecting licence applications covered much of the western Erongo Region (Figure 3), until the Ministry of Mines and Energy (MME) announced a moratorium on the issuing of licences for nuclear fuel in 2007. The aim of the moratorium was to give the authorities and stakeholders time to consider the pros and cons of uranium mining and to develop a management plan.

The "rush" ground to a halt when the uranium price started dropping, especially after the Fukushima disaster in 2011. A number of companies however proceeded with exploration activities, feasibility studies, process development and applications for mining licences. Of all the projects mooted in 2007, only one new mine has started up at the time of writing.

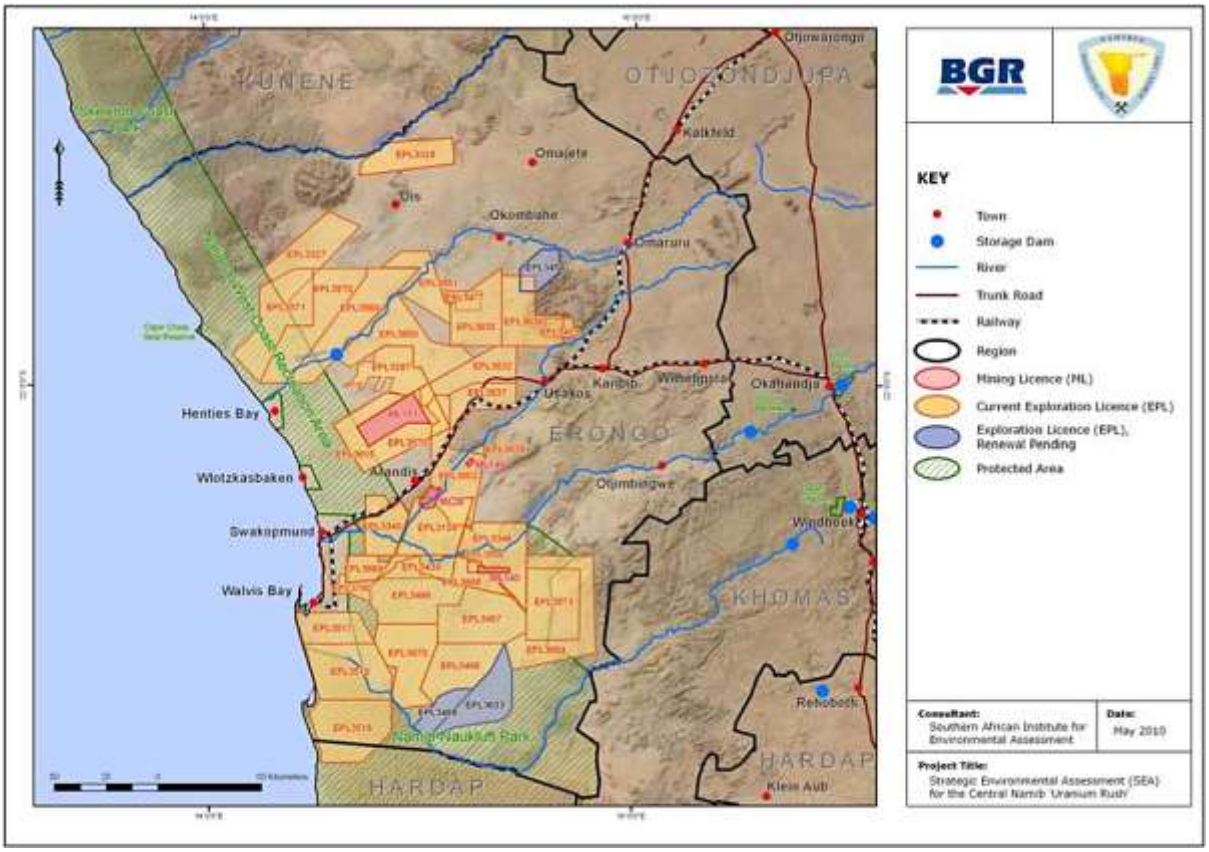

Figure 3: Nuclear Fuel Licences in the Erongo Region in 2010

Namibia generally welcomes investment in mining because it leads to increased revenue for the state, socio-economic development and job creation. However at the height of the exploration boom, members of the public and government institutions raised concerns about the impact that uranium prospecting and mining could have on the affected communities and the environment. They questioned whether infrastructure, housing and social services in the Erongo Region would be able to accommodate the establishment of new mines and the associated massive influx of job seekers. At the same time, the mining industry realised that unscrupulous miners could tarnish Namibia's reputation as a responsible uranium supplier and decided to establish the Namibian Uranium Association as a self-regulating body.

To address these concerns the Ministry of Mines and Energy in cooperation with the German Geological Survey (BGR) commissioned a strategic environmental assessment (SEA). This type of assessment allows decision makers to integrate the full spectrum of benefits and environmental considerations within the planning process, to provide vision and to generate a culture of collaboration among the mining industry, government, and the public. The SEA was carried out by Southern African Institute of Environmental Assessment in 2009-2010 and included a number of stakeholder consultation meetings. Concerns and recommended mitigation measures were documented in the SEA report.[1] The most important expected positive outcomes were:

- Strong economic growth of towns in the Erongo Region and improved quality of life
- Through careful stewardship of revenue and taxes from mining, the government will be able to address poverty and improve the lives of all Namibians
- Major impact on the macroeconomic indicators of Namibia
- Many direct and indirect new jobs, more opportunities for skills development and training
- Opportunity to fund scientific research and improve the body of scientific knowledge about the Namib environment and heritage resources
- Support the establishment of a Namibian nuclear energy industry including the beneficiation of uranium and the construction of a nuclear power station

These expected benefits could be threatened or offset by negative impacts if the development of new mines and associated infrastructure were not well managed. Note that the concerns listed below reflect public perceptions and do not necessarily reflect what is actually expected to happen.

- Mining is not sustainable; it is extremely vulnerable to fluctuations in the exchange rate and uranium prices
- There will be no added value to the country from uranium beneficiation; revenue will leave Namibia because of foreign ownership of mines
- Negative impact on the tourism industry could affect livelihoods of many people at the coast
- Escalating property prices will make houses unaffordable
- The existing infrastructure will not be able to cope and government will not be able to maintain it or upgrade it in time
- Insufficient water and power, power will cost more and outages will become more common
- The current waste disposal systems will not be able to cope with additional waste, especially hazardous waste and radioactive waste
- Influx of employees and job seekers causes a rise in diseases, especially HIV/AIDS and TB; will affect social cohesion, crime, crowding and informal housing areas; pressure on social services and amenities will result in the deterioration of these services and facilities
- Farmers may lose their land or be unable to farm anymore because of mine-related impacts
- Unethical companies may exploit workers
- Impact on health due to dust, exposure to radiation, increased traffic causing more accidents, higher risk of spills of hazardous materials in transit, groundwater pollution
- Noise and visual impact affect “sense of place” in the desert; loss of access to favourite recreation and tourist areas in the Namib
- Cumulative impact on water resources; biodiversity including the lichen fields; air quality and radiation; soil; marine environment (desalination plants); integrity of the National Park; increase in poaching, fishing and illegal harvesting
- Mines will not provide sufficient funding for effective closure measures; closure will not be adequate in the long-term resulting in long-term impacts on the environment

[1] MME (2010): Strategic Environmental Assessment for the Central Namib Uranium Rush. Ministry of Mines and Energy, Republic of Namibia, Windhoek

The Strategic Environmental Management Plan (SEMP) that was developed in the SEA identifies measures to avoid or mitigate the listed impacts. The SEMP consists of twelve environmental quality objectives (EQO) as shown in Table 2.[2]

Table 2: SEMP Environmental Quality Objectives

Icon	Issue	Aim of the Environmental Quality Objective
	1. Socio-economic Development	Uranium mining improves Namibia´s and the Erongo Region's sustainable socio-economic development and outlook without undermining the growth potential of other sectors.
	2. Employment	Promote local employment and employment equity.
	3. Infrastructure	Key infrastructure is adequate and well maintained, thus enabling economic development, public convenience and safety.
	4. Water	Ensure that the public have the same or better access to water in future as they have currently; quantity and quality of groundwater are not adversely affected by mining activities.
	5. Air Quality	Workers and the public do not suffer significant increased health risks as a result of exposure to dust emission from uranium mines.
	6. Health	Adequate health services are available to all; workers and the public do not suffer significant increased health risks from uranium mining.
	7. Effect on Tourism	The natural beauty of the desert and its sense of place are not compromised unduly by uranium mining; prevent conflicts between tourism and mining, so that both industries can coexist in the Central Namib.
	8. Ecological Integrity	Ecological integrity, flora and fauna are not compromised by mining; mines form conservation partnerships.
	9. Education	Erongo residents continue to have affordable and improved access to basic, secondary and tertiary education.
	10. Governance	Regulators and industry protect Namibia's reputation as a responsible uranium producer by means of ethical conduct and environmentally, socially and financially responsible practices.
	11. Heritage	Uranium exploration and mining will have the least possible negative impact on archaeological and palaeontological heritage resources.
	12. Mine Closure and Future Land Use	Maximize the sustainable contribution to society mines can make post-closure; minimize social, economic and biophysical impacts of mine closure.

[2] "Environmental quality objectives" are the SEA equivalent of recommended mitigation measures in EMPs.

The SEA concluded that the uranium rush presented significant opportunities for Namibia in terms of growth and development. The benefits would however come at a price because the uranium deposits are partly located in a proclaimed national park and one of the most popular tourist destinations in the country. Unless it was well managed and the necessary safeguards put in place, the uranium rush would negatively affect the environment and tourism on which livelihoods depend. To enhance the benefits and overcome these major challenges and constraints all tiers of government, state-owned enterprises and mining companies must successfully implement the necessary measures outlined in the SEA and SEMP. The desired outcome of the SEMP is that the utilization of Namibia´s uranium resources significantly contributes to the goal of sustainable development for the Erongo Region and Namibia as a whole.

The SEMP is thus an over-arching framework to address the cumulative impacts of existing and potential new developments. Implementation of the SEMP is guided by a steering committee that is chaired by the SEMP Office at the Geological Survey of Namibia (GSN), Ministry of Mines and Energy. Members include the Department of Water Affairs and Forestry (DWAF) in the Ministry of Agriculture, Water and Forestry (MAWF), the Ministry of Health and Social Services (MHSS), which includes the National Radiation Protection Authority (NPRA), the Ministry of Environment and Tourism (MET), the Gobabeb Research and Training Centre's Namib Ecological Restoration and Monitoring Unit (NERMU) and the Namibian Uranium Association (NUA).

The SEMP Office coordinates regular monitoring and sampling and ensures that data on environmental performance indicators are collected. This involves consultation with authorities and organisations such as Ministry of Education, Arts and Culture, Ministry of Finance, Ministry of Labour, Erongo RED, NamPort, NamPower, NamWater, Roads Authority, Swakopmund Municipality and Walvis Bay Municipality.

Desired Outcome 1.1.	**Income and economic opportunities from uranium mining are optimized.**			
Target 1.1.1.	**Contribution of mining to the economy increases over time.**			
Indicator 1.1.1.1.	**Royalties are paid in full by mining companies.**			
Data Source	**SEMP Office/MoF/NUA**			
Status:	**NOT MET**	**IN PROGRESS**	**MET**	**EXCEEDED**

Figure 4: Example of SEMP Indicator and Rating Options

The aims of the twelve EQOs in Table 2 are broken down into desired outcomes, targets and indicators (Figure 4). The indicators are monitored throughout the year and evaluated in annual SEMP reports to measure the positive and negative impact of uranium mining on the Erongo Region. Each indicator is assessed according to a four-tiered colour-coding system that indicates whether it has been exceeded, met, not met or is still in progress. Recently many indicators had to be rated not applicable because the pertinent activity did not take place in the year under review. The SEMP Office prepares annual SEMP reports in co-operation with NERMU and NUA. These reports are published on the MME/GSN website which is accessible to stakeholders and the public.

The EQOs have strong links with Namibia's national development plan, NDP5, as shown in Table 3. EQOs relating to all four NDP pillars highlight the contribution that mining makes to the nation.

Table 3: Links between SEMP EQOs, NPD5 and UN Sustainable Development Goals

Icon	SEMP EQO	National Development Plan NDP5		UN Sustainable Development Goals
	1. Socio-economic Development		Economic development	
	2. Employment		Human capital development	
	3. Infrastructure		Economic infrastructure	
	4. Water		Natural resource use, health & environmental management	
	5. Air Quality			
	6. Health		Social development	
	7. Effect on Tourism		Economic development	
	8. Ecological Integrity		Environmental management	
	9. Education		Human capital development	
	10. Governance		Accountability & transparency	
	11. Heritage		Environmental management	
	12. Mine Closure and Future Land Use		Natural resource use & env. management	

The table also associates the EQOs with the United Nations Sustainable Development Goals. Only goal number 13 Climate Action is not covered by an EQO. Number 5 Gender Equality does not appear in the table but is addressed in EQO 2 under employment equity.

URANIUM MINING SCENARIO IN 2017

Kazakhstan, Canada and Australia are still the world's top uranium producers, while Namibia ranks fifth with production figures similar to Niger and Russia (Figure 5) [3]. Namibia is expected to join the ranks of the major producers when Swakop Uranium's Husab Mine reaches nameplate capacity.

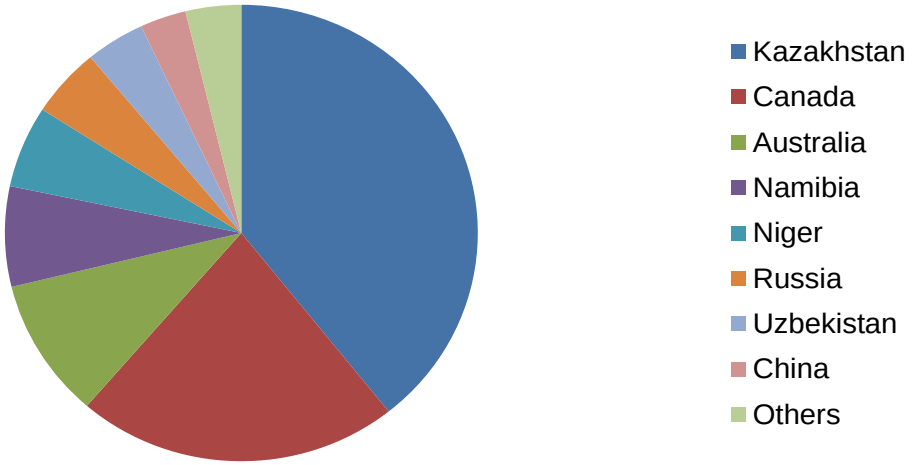

Figure 5: World Uranium Producers in 2017

The global market was characterised by a significant over-supply of uranium and low demand from utilities that saw no need to further augment their existing stockpiles. The uranium spot price hovered around US$20 per pound of uranium trioxide (U_3O_8) in 2017. [4]

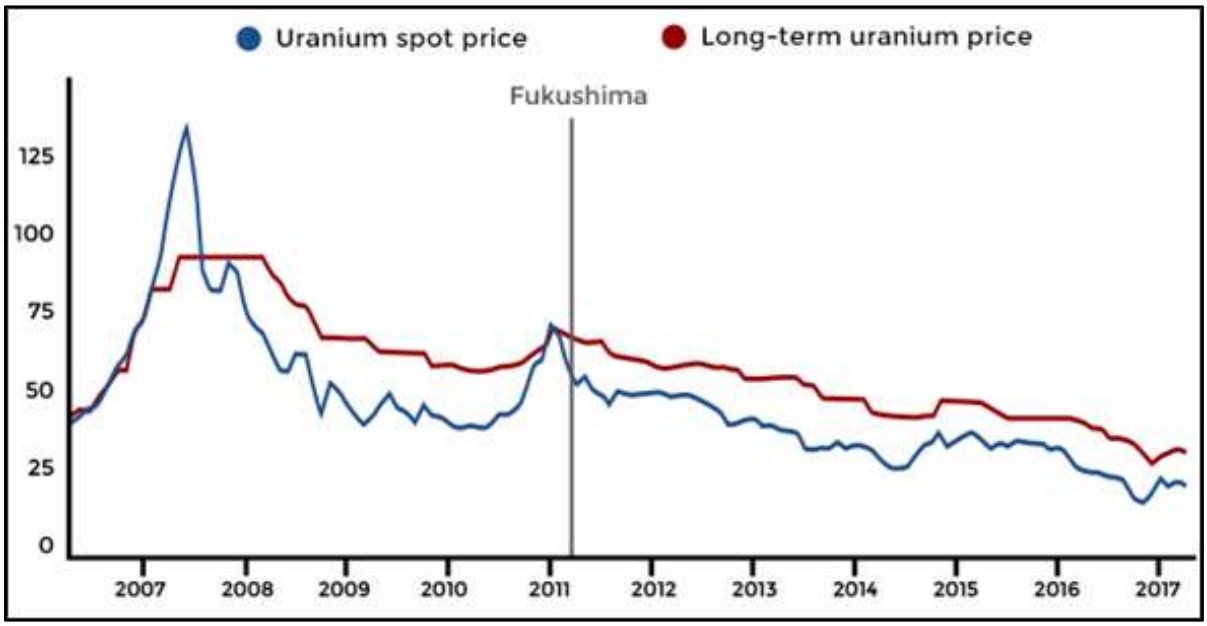

Figure 6: U_3O_8 Spot Price 2012-2017

[3] www.world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/world-uranium-mining-production.aspx

[4] www.uxc.com/p/prices/UxCPriceChart.aspx?chart=spot-u3o8-full

The uranium market price has been declining since 2007, except for a short recovery in 2011 that was quickly reversed after the Fukushima event (Figure 6).[5] The cyclical nature of commodity markets implies that an upturn can be expected sooner or later. A spot price of at least US$50-60 per pound would however be required for the profitability of many Namibian projects that are currently at the exploration or development stage.

Despite the low demand and depressed commodity prices, the Namibian uranium mining sector registered a strong growth in real value added to 23.4 percent in 2017 compared to the rise by 13.6 percent recorded in 2016.[6] The increase was attributed to the Swakop Uranium's additional production. With Husab Mine starting production in December 2016 Namibia hosted three operating mines in 2017, while six projects are at various stages of development (Table 4). Figure 7 on the next page shows the location of mining licences and exploration areas.

Table 4: List of Uranium Mines and Projects

Full company name	Parent company	Mine site name(s)
Langer Heinrich Uranium (Pty) Limited	Paladin (Australia)	Langer Heinrich Mine
Rössing Uranium (Pty) Limited	Rio Tinto (UK)	Rössing Mine
Swakop Uranium (Pty) Limited	Taurus Minerals (China)	Husab Mine
AREVA Resources Namibia (Pty) Limited, now Orano Mining Namibia	AREVA, now Orano (France)	Trekkopje Mine
Bannerman Mining Resources Namibia (Pty) Limited	Bannerman (Australia)	Etango, Ondjamba, Hyena
Marenica Minerals (Pty) Limited	Marenica (Australia)	Marenica
Reptile Mineral Resources and Exploration (Pty) Limited	Deep Yellow Limited (Australia)	Tumas, INCA, Omahola and Tubas prospects
Valencia Uranium (Pty) Limited	Forsys Metals (Canada)	Norasa
Zhonghe Resources (Namibia) Development (Pty) Limited	China Uranium Corporation (China)	Zhonghe (ML 177)

The following paragraphs give short summaries on the status of the various companies and their activities in 2017.[7]

Langer Heinrich Uranium processed medium-grade stockpiles throughout the year. Due to the continuing low uranium price and to protect cash flows, the company focussed on meeting production targets, cost and efficiency controls. These objectives were negatively impacted by lower than expected stockpile grade, problematic ore type resulting in settling and compaction issues in the counter-current decantation circuit and water availability problems. Tailings storage facility (TSF) #5 was commissioned in July 2017. TSF #3 and TSF #5 were fenced in with the approval of the Ministry of Environment and Tourism. The purpose of the fences was to protect wildlife from becoming entrapped in the tailings material; this has so far proved successful.

Rössing Uranium began to see the results of the work put into its safety and mining operations over the past three years. It also continued to invest in its most important asset — its people — for the

[5] www.cameco.com
[6] NSA Preliminary Annual National Accounts 2017
[7] Based on Chamber of Mines 2017 Annual Review

sustainability of the business. Rössing Uranium put a significant amount of work into opening up high-grade ore areas and started to see the results of this investment in form of steadily increasing production output. Compared to a production of less than 2,000 tonnes of uranium oxide per year in 2014 to 2016, the output increased to 2,110 tonnes in 2017.

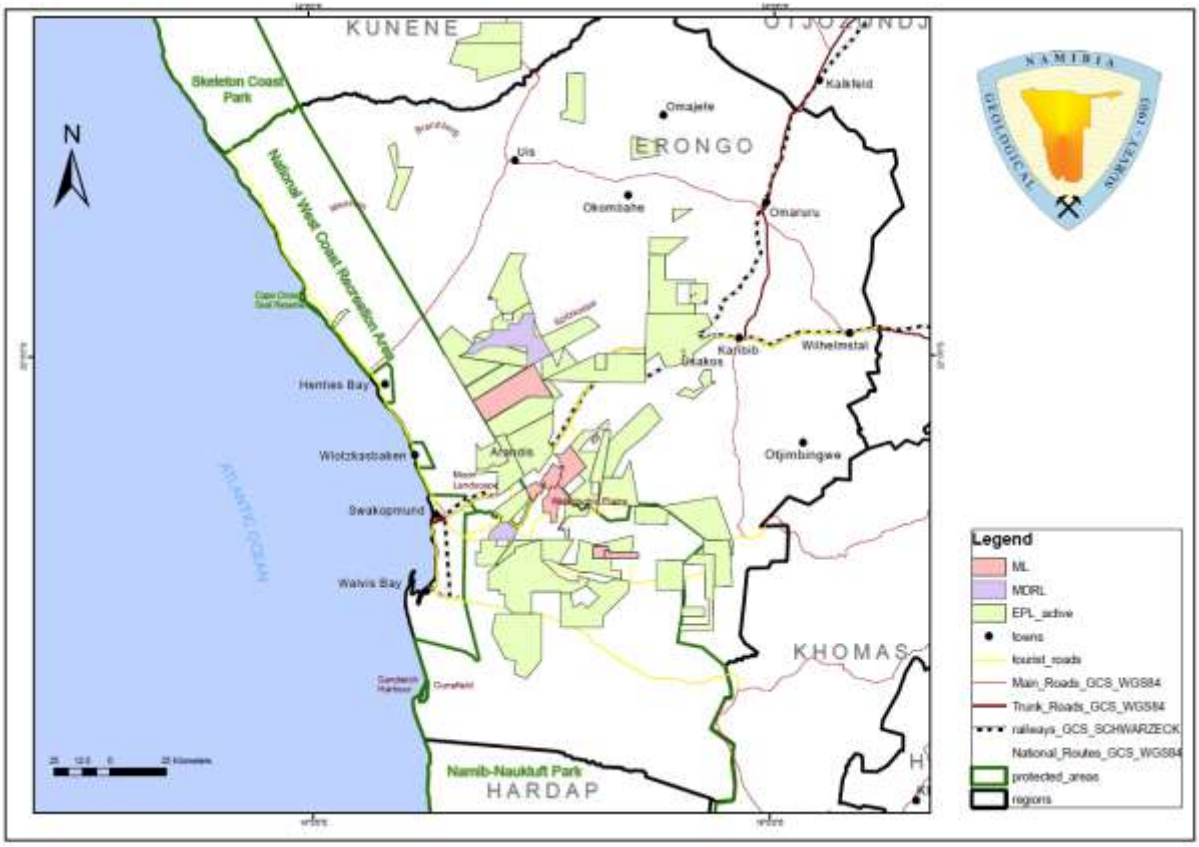

Figure 7: Nuclear Fuel Mining Licence and Exploration Areas in the Erongo Region 2018

Swakop Uranium completed the construction of its Husab mine and produced 1345 tonnes of uranium oxide in 2017. The product was shipped via the port of Walvis Bay in August and October 2017.

Figure 8: Husab Mine (Photo by Swakop Uranium)

Overburden stripping had started in 2014 to expose the uranium-bearing ore ready for the start of processing operations and since then over 6 million tonnes of ore have been moved. Throughput of the processing plant (Figure 8) was continuously ramped up during the year with the aim of reaching the nameplate production in 2018.

AREVA Resources Namibia carried out its care and maintenance programme at Trekkopje Mine as scheduled and concluded its metallurgical research programme, which explored ways of pre-concentrating the ore by discarding most of the waste material. Investigated options such as finer crushing, scrubbing or flotation were found to be technically feasible. An optimized process was developed that enhances the permeability of the heap by adding cement at the agglomeration stage and recovers a substantial part of the reagents through membrane technology. In January 2018 AREVA changed its name to Orano and the local company was registered as Orano Mining Namibia.

Bannerman Mining Resources (Namibia) continued the metallurgical test programme at its Heap Leach Demonstration Plant specifically focussing on the ion exchange and nanofiltration processes. Bannerman completed its Etango processing optimization study (Figure 9) which reduces the project's capital cost by an estimated US$73 million and targets a further US$3 per pound reduction in operating costs. The company received its mineral deposit retention licence (MDRL 3345) covering the area where the Etango project is located.

Figure 9: Process Optimization Study (Photo by Bannerman Mining Resources)

Marenica Minerals was granted a mineral deposit retention licence for its EPL in 2016 to await an increased uranium price. In the meantime, metallurgical test work continued to widen application of the company's proprietary processing technology. The company is exploring opportunities to apply its process to third party resources in Namibia. Reptile Mineral Resources and Exploration intensified its exploration activities in 2017 and completed 18,451 m of reverse circulation and 521 m of diamond drilling. This effort led to the delineation of a highly prospective regional target in palaeochannel deposits that was not previously known. A significant additional uranium resource was demarcated in the Tumas 3 area.

With a definitive feasibility study and a mining licence in place, Valencia Uranium will be construction-ready once the uranium price increases. Zhonghe Resources Namibia updated the economic evaluation and feasibility study of their uranium deposit. They conducted geological section surveys covering 18 kilometres and completed 1409 m of diamond drilling, as well as 48 geochemical assays. Rehabilitation was carried out after the completion of geological and geophysical surveys in line with the EIA and EMP.

In January 2017, the Minister of Mines and Energy lifted the moratorium on new exclusive prospecting licences for nuclear fuels that had been in place since 2007, and by the end of the year MME had already received more than 40 applications for new nuclear fuel EPLs and issued one uranium mining licence.

EVALUATION OF THE ENVIRONMENTAL QUALITY OBJECTIVES

EQO 1. Socio-Economic Development

Aims of this EQO: Uranium mining improves Namibia and the Erongo Region's sustainable socio-economic development and outlook without undermining the growth potential of other sectors.

Mining plays a vital role in the Namibian economy. In 2017, the mining sector made a direct contribution of 12.8% to the GDP of the country, compared to 11% in the previous year.[8] The uranium industry however contributed only 1% due to the low demand for uranium on the world market. Countries that are rich in natural resources such as minerals and oil are often overly reliant on mining and fail to develop secondary and tertiary industries that will sustain the economy when the primary resources run out. The term "natural resource curse" is often used to describe a situation where a government does not reinvest the income it reaps from its resources in socioeconomic development that benefits the entire population.[9] This may happen to Namibia if the income from its mining industry is not well managed. It is therefore the objective of EQO 1 to ensure that the uranium industry contributes its fair share to the socio-economic development of the Erongo Region and Namibia as a whole.

The indicators of this EQO measure the fiscal revenue generated through royalties and corporate taxes, as well as local procurement of goods and services within Namibia. The last indicator specifies that uranium processing companies should not be granted EPZ status. Another indicator that could have been considered relates to income earned through local beneficiation of raw materials, an opportunity that the Namibian government wants to promote. This is not an option for uranium, because it can only be processed at a few facilities around the world (Figure 10) due to the complexity and cost of the uranium conversion and enrichment technology.

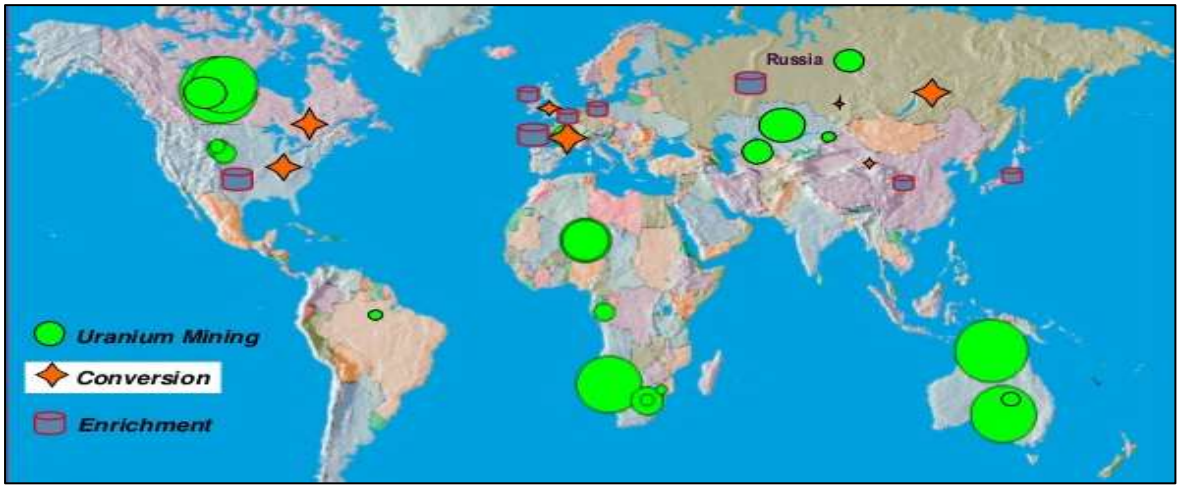

Figure 10: Uranium Conversion and Enrichment Facilities (Map by AREVA)

[8] National Statistics Agency, Preliminary Annual National Accounts 2017

[9] McMahon, G.J. & Moreira, S. (2014): The Contribution of the Mining Sector to Socioeconomic and Human Development, Extractive Industries for Development Series, no. 30, World Bank Group

Desired Outcome 1.1.	**Income and economic opportunities from uranium mining are optimized.**			
Target 1.1.1.	**Contribution of mining to the economy increases over time.**			
Indicator 1.1.1.1.	**Royalties are paid in full by mining companies.**			
Data Source	**SEMP Office/MoF/NUA**			
Status:			**MET**	

Mining royalties are levied as a percentage of the export value of the commodity that a mine produces. For uranium (nuclear minerals) royalties are 3% of the sales price, which means that revenue to the state is still generated even if a mining company does not make a taxable profit. Operating mines paid the royalties that were levied in 2017 as shown in Table 5.

Table 5: Royalties Paid by Uranium Mining Companies

Company	2017 (N$)	2016 (N$)	2015 (N$)	2014 (N$)	2013 (N$)
Langer Heinrich	40,603,160	61,670,071	60,696,272	65,175,939	56,277,197
Rössing Uranium	77,833,191	80,352,444	54,312,447	56,828,000	85,240,000
Swakop Uranium	9,135,083	No uranium production			

Langer Heinrich Uranium reported that their royalty payments were affected by the continued depressed uranium spot price, lower production in 2017 owing to the mining curtailment plan and the weakening of the Namibian dollar compared to the US dollar. Rössing Uranium's royalties for 2017 were only slightly lower than in 2016. Swakop Uranium only started producing uranium oxide in December 2016.

Motivation of status: The indicator was **MET** because the full amount of royalties that MME claimed were paid by the operating mines**.**

Indicator 1.1.1.2.	**Increasing economic contribution by uranium mines over time.**			
Data Source	**SEMP Office/MoF/NUA**			
Status:			**MET**	

This is a new indicator. The information in Figure 11 was taken from the Chamber of Mines 2017 annual review that contains data from 2000-2017. Comparing the economic contribution derived from uranium mining at 2010 constant prices (to correct for inflation) results in a generally rising trend, notwithstanding some ups and downs caused by fluctuations in the uranium price.

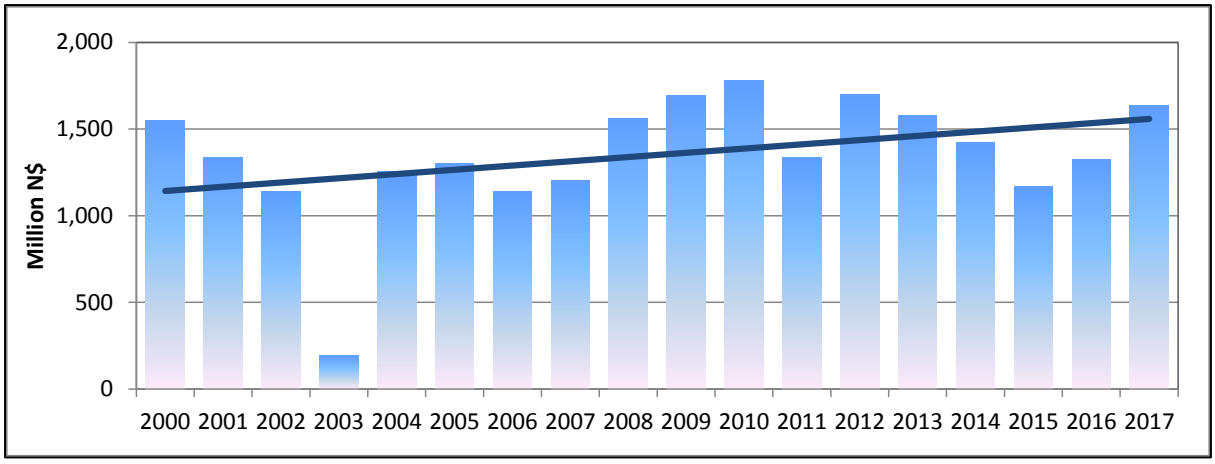

Figure 11: Value Added by Uranium Mining Companies (2010 Constant Prices)

Motivation of status: The indicator was **MET** because the economic data indicate a rising contribution by uranium mines over the last 18 years. The last three years have also seen a significant increase.

Indicator 1.1.1.3.	**Increasingly, inputs that can be sourced locally are not imported.**			
Data Source	**NUA**			
Status:			**MET**	

The indicator measures the percentage of total procurement spent locally within Namibia. Table 6 provides figures for the last five years to see whether local procurement has been increasing over time. Langer Heinrich increased their level of local purchasing to reach 91% in 2017, while Rössing Uranium's share decreased somewhat compared to 2016, but was still higher than in 2015.

Table 6: Percentage of Local Procurement of Goods and Services by Operating Uranium Mines

	Local procurement of goods and services as % of total procurement				
Company	**2017**	**2016**	**2015**	**2014**	**2013**
Langer Heinrich	91%	84%	85%	71%	78%
Rössing Uranium	74%	77%	73%	68%	64%
Swakop Uranium	68%	(49%)	NA	NA	NA
Average	**78%**	**81%**	**79%**	**70%**	**71%**

The total value of procurement that Swakop Uranium awarded to Namibian owned and registered companies was 48.9% of the total awarded value.[10] It is not clear if this figure refers to a specific

[10] Article in The Namibian newspaper of 3 August 2016 citing Zheng KePing, CEO of Swakop Uranium, www.namibian.com.na

year or to procurement during the construction period of the Husab Mine. Figure 12 shows the split between local and foreign suppliers in 2017.

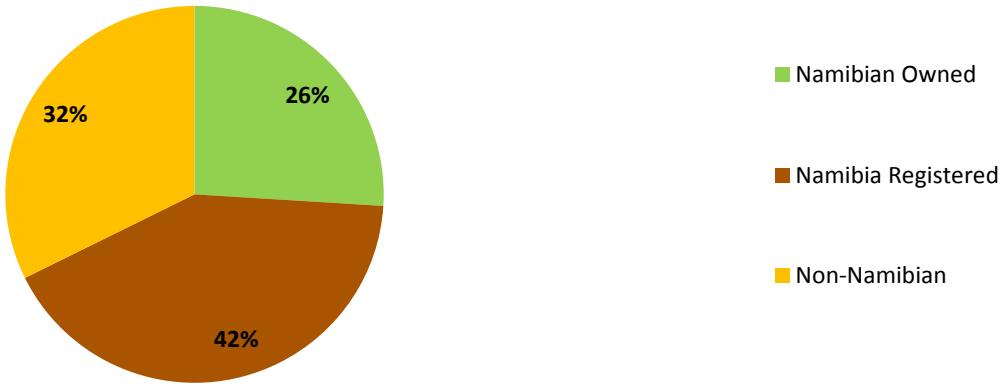

Figure 12: Swakop Uranium Procurement in 2017

Figures for exploration companies and mines under development are not included in Table 6 because the indicator only applies to operating mines. It is however worth mentioning that AREVA Resources Namibia, Bannerman Mining Resources Namibia and Reptile Mineral Resources and Exploration purchased most of their goods and services locally.

Motivation of status: The indicator was **MET** because the average percentage of local procurement at the operating mines has generally increased over time. The lower average in 2017 was due to the inclusion of Swakop Uranium as a new operating mine.

Indicator 1.1.1.4.	**Processing companies connected to uranium mines are not granted EPZ status.**			
Data Source	**SEMP Office**			
Status:			**MET**	

As far as could be established there were no existing or new uranium-processing companies with EPZ status in 2017. The Ministry of Finance announced in March 2018 that the Export Processing Zones Act (Act 9 of 1995) will be repealed and Special Economic Zones will be introduced. Current operators with EPZ status would be subject to phase-out provisions.

Motivation of status: The indicator was **MET** because there were no processing companies with EPZ status in 2017.

****

Summary of performance: EQO 1

Total no. indicators assessed 4				
	NOT MET	**IN PROGRESS**	**MET**	**EXCEEDED**
Number of indicators in class	0	0	4	0
Percent of indicators in class	0%	0%	100%	0%

Overall performance: Indicators of socioeconomic development are related to the payment of royalties and taxes, local procurement and EPZ status for processing companies. As in previous years they were all **MET** in 2017.

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EQO 2. Employment

Aims of this EQO: Promote local employment and employment equity.

The aim of EQO2 is to create jobs for local residents and to promote equity by adhering to the requirements of the Affirmative Action (Employment) Act. Uranium mining companies are expected to give preference to Namibian citizens, especially people residing in the vicinity of the mine, and to work towards gender equality by employing women at all levels of mining companies.

Namibia has put in place a number of policy measures and programmes to encourage local and foreign investment. The government's policy is aimed at the promotion of growth, increasing employment and alleviating poverty, as well as reducing the unequal distribution of income. The government has also taken measures to create employment and address labour market inequalities. Among the policy measures in place is the Affirmative Action (Employment) Act No. 29 of 1998 that aims to enhance participation and integration of previous disadvantaged groups of the society in the labour market and to promote equal opportunities in employment.

Despite all efforts, the unemployment rate increased from 28% in 2014 to 37% in 2017[11] and this remains a grave concern. In 2017, the mining industry provided jobs to 9643 permanent and 889 temporary employees, as well as 6373 employees of subcontracting firms[12]. Jobs in mining only accounted for 1.5% of the country's total workforce, but mine employees are generally better paid than those in other sectors and their purchasing power makes a sizeable contribution to the economy. The multiplier effect in service industries is estimated to support over 110 000 additional jobs according to the Namibian Chamber of Mines.

Desired Outcome 2.1.	**Mainly locals are employed.**			
Target 2.1.1.	**Uranium companies hire locally where possible.**			
Indicator 2.1.1.1.	**During operational phase all mining companies to comply with their employment equity target (certificate).**			
Data Source	**SEMP Office/EEC/NUA**			
Status:			**MET**	

All the operating mines received an AA compliance certificate for the reporting period and employed predominantly Namibian staff. The percentage over local employees varied from 92% at Swakop Uranium to 96% at Langer Heinrich and 98.4% at Rössing Uranium. Exploration companies with fewer than 25 employees do not need employment equity compliance certificates.

[11] National Statistics Agency 2018, www.nsa.org.na
[12] Chamber of Mines of Namibia 2017 Annual Review

AREVA Resources Namibia retrenched 16 employees in mid-2017. None of the other companies reported any retrenchments during the year, though Paladin announced in early 2018 that the Langer Heinrich Mine would be put in care and maintenance and an unspecified number of employees would be retrenched.

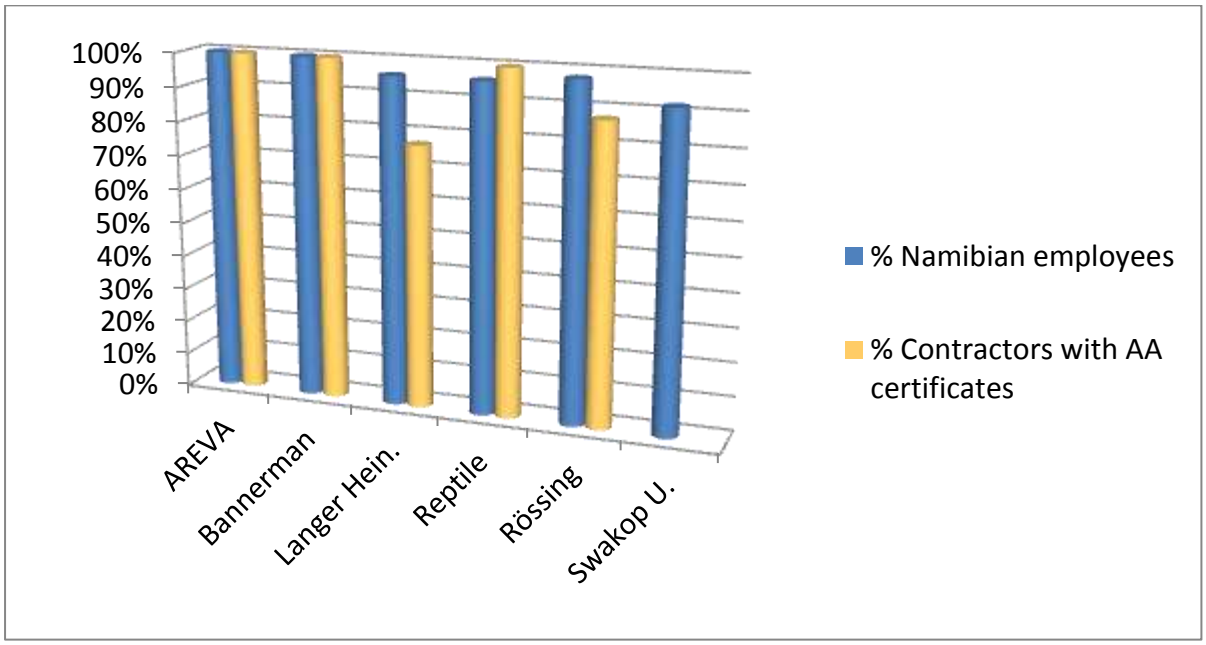

Figure 13: 2017 Employment Equity Data

Another important aspect mentioned in the SEA report but not taken up in the indicator is the question whether contractor companies employed at uranium mines meet the employment equity target. In 2017, Langer Heinrich Uranium reported that 77% of their contractor companies complied with the provisions of the Act, while the relevant figure for Rössing Uranium was 87.5%. Swakop Uranium did not provide data and other companies either did not employ contractors or the contractors had fewer than 25 employees.

Motivation of status: The operational mines complied with the provisions of the Affirmative Action (Employment) Act and met their employment equity targets.

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Summary of performance: EQO 2

Total no. indicators assessed	1			
	NOT MET	**IN PROGRESS**	**MET**	**EXCEEDED**
Number of indicators in class	0	0	1	0
Percent of indicators in class	0%	0%	100%	0%

Overall performance: The only indicator of EQO 2 has been **MET** again, because the majority of the permanent workers and contractors at uranium mines were Namibian citizens and companies have received AA compliance certificates.

********** ********** ********** ********** **********

EQO 3. Infrastructure

Aims of this EQO: Key infrastructure is adequate and well maintained, thus enabling economic development, public convenience and safety.

Poor infrastructure impedes a nation's economic growth and international competitiveness. Infrastructure has a bearing on a country's attractiveness to foreign investors and on its ability to compete with other countries. It ensures that people, goods and services can be moved in the most effective ways possible. Failure to invest in infrastructure means a failure to sustain and develop Namibia's social and economic wellbeing. Investment in infrastructure is an ongoing process as there are always changes in technology and the business environment. The growing economy drives new needs, while existing infrastructure has to be maintained, updated or replaced.

The aim of this EQO is to ensure that key infrastructure in the Erongo Region is adequate to meet all users' requirements and well maintained, thus enabling economic development, public convenience and safety, whilst minimising environmental impacts. Amongst the relevant infrastructure developments are good housing, social services and amenities, water and electricity supply and an efficient and safe transportation system.

The 31 indicators of the infrastructure EQO examine each of these points, which are mostly in the public domain or concern linear infrastructure that public utilities use to supply water and electricity to mines. The topic of waste management mostly concerns landfill sites and recycling systems managed by urban centres, though it includes mine-specific indicators referring to the environmentally sound management of mineral waste too.

Desired Outcome 3.1.	**Existing, proclaimed towns are supported and mine employees are integrated in society.**			
Target 3.1.1.	**Most employees are housed in proclaimed towns.**			
Indicator 3.1.1.1.	**Mines do not create mine-only townships or suburbs.**			
Status:			**MET**	
Indicator 3.1.1.2.	**There are no on-site hostels during the operational phase of a mine.**			
Data Source	**SEMP Office/NUA**			
Status:			**MET**	

Operating mines and exploration projects are housing or planning to house employees in proclaimed towns and confirmed that they were not planning to establish mine-only townships, suburbs or on-site hostels. Swakop Uranium still has approximately 200 contractors staying at their construction camp. They are waiting for MET to make a decision about the future of the camp.

Motivation of status: Both these indicators were rated as **MET** because the operating mines do not have permanent on-site accommodation or plans to establish mine-only townships.

Desired Outcome 3.2.	**Roads in Erongo are adequate for uranium mining and other traffic.**
Target 3.2.1.	**Roads are well maintained; traffic frequency is acceptable for tourism/ other road users and traffic is safe.**
Indicator 3.2.1.1.	**Surfaced roads are adequate and safe for traffic frequency.**
Data Source	**Roads Authority (RA)**
Status:	**NOT MET**

This new indicator has been added because the existing indicators only addressed gravel roads. Traffic safety on surfaced roads was highlighted as an issue in the 2016 SEMP report. Members of the mining industry and other stakeholders such as the Erongo Regional Road Safety Council, consider that the traffic volume on the T0202 (former B2), especially the number of heavy vehicles has increased to the extent that the road has become unsafe. A recommendation was therefore made to the Roads Authority to upgrade the road to double lanes or create passing lanes at least up to Arandis. In 2016/17 the Roads Authority had budgeted for the detailed design of the Karibib-Swakopmund road upgrade to two-plus-one lane, but no funds were provided for the actual construction in the next five years.[13] The budget for 2018/19[14] likewise only shows funds allocated to two construction projects in the Erongo Region:

- Swakopmund-Henties Bay-Kamanjab road upgrading (402 km): N$145,790,000
- MR44 Swakopmund-Walvis Bay road upgrading (44km): N$205,822,000
- Swakopmund-Walvis Bay road rehabilitation (30 km): no budget allocated
- Upgrading to 2+1 cross-section, T0202 Karibib-Swakopmund: no budget allocated

The issue has been highlighted for discussion at ministerial level. NUA's Services working group will also approach the Walvis Bay Corridor Group in this regard.

Motivation of status: The indicator was **NOT MET** because there was no progress in 2017.

Indicator 3.2.1.2.	**All key gravel roads are maintained timeously to avoid deterioration.**
Data Source	**RA/NUA**
Status:	**MET**

The Roads Authority (RA) has followed its maintenance programme for key gravel roads, such as the M52, M44 and the M36 road from Walvis Bay into the Namib-Naukluft National Park (NNNP). With-

[13] Roads Authority : Five Year Budget For The Period 2017/18 To 2021/22 Financial Year
[14] Roads Authority : Five Year Budget For The Period 2018/19 To 2022/23 Financial Year

in the national park Bannerman Mining Resources continued to grade the road along the Moon Landscape to the Welwitschia Drive every two months and once a year grades the entire road. Swakop Uranium has appointed a contractor to grade the Welwitschia Drive from the C28 turn-off to the Husab exploration campsite. During 2017 this was done once or twice a month. Generally, the volume of mine-related traffic in the park has decreased significantly compared to the height of the uranium rush and NUA did not receive any complaints from tourists about the roads in the Namib section of the park.

Motivation of status: This indicator was **MET** because the key gravel roads used by mining companies and tourists were mostly maintained in reasonable condition.

Indicator 3.2.1.3.	**Un-surfaced roads carrying >250 vehicles per day need to be tarred.**			
Data Source	**RA**			
Status:		**IN PROGRESS**		

The RA confirmed that all gravel roads with traffic of more than 250 vehicles per day should be upgraded to bitumen standard, but because of insufficient funds not all such roads can be tarred immediately. To highlight the magnitude of the problem it was reported that the Road Fund Administration (RFA) collected road user charges of N$2.2 billion in the 2016/17 financial year and allocated N$1.92 billion of this amount to the road sector.[15] The expected revenue for the next five years is N$2.6 billion per year. Considering that N$1.55 billion will be needed to upgrade the road from Windhoek to the Hosea Kutako airport and that the completion of the road between Windhoek and Okahandja is expected to cost another N$700 million over the next three years[16], one can understand the slow pace of road construction in other regions of the country.

Most of the C28 road from Swakopmund to the Langer Heinrich mine turn-off has already been tarred, while the upgrading of the MR44 from Swakopmund to Walvis Bay east of the dunes is planned for completion in 2019. The gravel road from Swakopmund to Uis via Henties Bay is currently being upgraded to bitumen standard. There are also plans to tar the MR36 (C14) gravel road in future, though not within the next five years.

Motivation of status: Due to insufficient funds for road upgrading the Roads Authority has not yet been able to tar all roads carrying >250 v/d. Because plans are in place and progress has been made the indicator was rated **IN PROGRESS**.

Indicator 3.2.1.4.	**The B2 tar road is free of pot-holes and crumbling verges.**			
Data Source	**RA**			
Status:			**MET**	

[15] Article in The Namibian of 15 November 2017 citing Ali Ipinge, CEO of RFA, www.namibian.com.na
[16] Roads Authority : Five Year Budget For The Period 2017/18 To 2021/22 Financial Year

The Roads Authority reported that the T0202 (former B2) tar road was free of potholes and crumbling verges and in reasonably good condition between Swakopmund and the Arandis turn-off. Part of this section has been resealed in early 2018. Maintenance work on crumbling verges was carried out as and when required throughout the year 2017.

Motivation of status: The Roads Authority is continuously repairing potholes and crumbling verges on the B2 in the uranium province, resulting in this indicator being **MET**.

Indicator 3.2.1.5.	**Road markings and signage are in place and in good condition.**			
Data Source	**SEMP Office/RA**			
Status:			**MET**	

Road signs and markings were in place, but the cat's eyes that were used on the B2 in the past have not been replaced. This makes it difficult to see the road edges at night and in heavy fog, contributing to the hazards experienced on this road. The NUA Sustainable Development Committee recommended that cat's eyes should be fitted between Swakopmund and Arandis to make the road safer.[17]

Motivation of status: Signage along the roads was in place and in generally good condition, the indicator was therefore **MET**.

Indicator 3.2.1.6.	**MR44 previously known as D1984 (Swakopmund to Walvis Bay east of dunes) is tarred.**			
Data Source	**SEMP Office/RA**			
Status:		**IN PROGRESS**		

Upgrading of the MR44 road to a dual carriageway and bitumen standard started in 2016 and is planned for completion in June 2019.[18]

Motivation of status: The indicator was rated **IN PROGRESS** because tarring of the MR44 started in 2016 and is progressing as planned.

Indicator 3.2.1.7.	**90% of traffic on the B2 coastal road (Swakop-WB) is light vehicles.**			
Data Source	**SEMP Office/RA**			
Status:				

[17] NUA 2017
[18] Ministry of Works & Transport website

The recommendation in the SEA report from which this indicator was derived reads as follows: "*All heavy traffic (except local deliveries to Langstrand and the coastal developments between Swakopmund and Walvis Bay) must be directed onto the upgraded D1984*." This implies that the indicator will only be applicable once the MR44 road has been tarred, because only then can heavy vehicle traffic be banned from the coastal road.

Motivation of status: The indicator will be regarded as **NOT APPLICABLE** until the MR44 road has been tarred.

Indicator 3.2.1.8.	**Mining traffic on predominantly tourist roads meets agreed conditions.**			
Data Source	**NUA**			
Status:			**MET**	

The 'agreed conditions' mentioned in this indicator are that 1) the traffic frequency is acceptable for tourists and other road users and 2) that traffic is safe. Some mines have constructed their own roads to avoid interference with tourist traffic. Swakop Uranium, for instance, reported that traffic was limited on NNNP roads within their mining licence and EPL areas to exploration activities and the relevant environmental monitoring and construction activities that were underway in 2017. All main traffic is directed via the permanent access road and unauthorised usage of the NNNP roads is not allowed. All personnel are inducted on the usage of these roads and security check points are in place to restrict access.

The last few years have seen a significant reduction in mining traffic on tourist roads, mostly due to the completion of Swakop Uranium's private road to Husab mine and the slowdown in uranium exploration activities. Access to Langer Heinrich Mine is along a mostly tarred section of the C28 road in the Namib-Naukluft Park, while Reptile Mineral Resources and Exploration occasionally used tourist roads for exploration work in 2017.

Motivation of status: Seeing that the mine-related traffic frequency was acceptable and no safety incidents were reported it can be concluded that the agreed conditions have been **MET**.

Desired Outcome 3.3.	**Optimum use of rail infrastructure.**			
Target 3.3.1.	**Most bulk goods are transported by the existing railway.**			
Indicator 3.3.1.1.	**80% of all bulk goods (all reagents and diesel) delivered to mines and associated industries, are transported by rail.**			
Data Source	**NUA/Transnamib**			
Status:			**MET**	

Rössing Uranium, the only mine that has railway access, transported 90% of its bulk goods (sulphuric acid) by rail from Tsumeb and Walvis Bay. Some reagents that are used in smaller quantities were transported by road (Table 7).

Table 7: Transportation Mode of Bulk Goods to Mining Companies

Company	Tonnes by rail	Tonnes by road	% by rail
Rössing Uranium	293,279	33,775	90%

Motivation of status: The indicator was **MET** because 90% of Rössing Uranium's bulk goods were transported by rail in 2017.

Desired Outcome 3.4.	**Walvis Bay harbour is efficient and safe.**			
Target 3.4.1.	**The harbour authorities provide reliable, accessible and convenient loading, offloading and handling services.**			
Indicator 3.4.1.1.	**Average loading rate for containers is >25 containers per hour.**			
Status:			**MET**	

Walvis Bay, Namibia's largest port is progressively becoming a gateway to other countries in the southern African region. In order to deal with higher levels of throughput, Namport has steadily improved its cargo-handling facilities such as cranes and reach stackers. The container terminal can accommodate ground slots for 3,875 containers and handle about 250,000 containers per annum.[19]

Table 8 shows the monthly average of berth moves per hour (BMPH) in 2017.[20] The average loading rates of 25.6 moves per hour for all vessels and 27.3 for ships that needed more than 500 moves were above the target of >25 containers per hour.

Table 8: Namport Berth Moves per Hour in 2017

Month	BMPH for MSK (ignoring CD, low exchange, all delays)	BMPH for vessels ≥500 moves against agreed target of 30 BMPH
January	23.8	24.1
February	25.2	29.6
March	24.4	25.9
April	26.5	27.1
May	29.0	31.5
June	26.6	31.0
July	23.7	25.9
August	29.1	27.3
September	26.1	28.7
October	21.8	24.2
November	26.0	26.0
December	25.0	26.6
Average	**25.6**	**27.3**

[19] NamPort website www.namport.com.na
[20] Pers. comm. NamPort 2018

Namport invested N$440 million to purchase four ship-to-shore cranes that were shipped from Shanghai in December 2017. [21] The 122 m high cranes are one of the major components of the new container terminal. Each crane has a reach of 69 m and can move 20-40 containers per hour. These cranes are known for their fast operation that will speed up ship turnaround times and give the port a significant competitive advantage. A normal mobile harbour crane can only move 15 containers per hour on average.

Figure 14: Ship-to-Shore Cranes as Purchased by Namport

Motivation of status: The status of this indicator changed from **IN PROGRESS** to **MET** because the average container handling rate exceeded 25 moves per hour in 2017.

Indicator 3.4.1.2.	**Average waiting time for ships to obtain a berth is <12 hours.**			
				EXCEEDED

Namport reported no waiting time for vessels berths before being allocated a berth in 2017.[22]

Motivation of status: The indicator was rated as **EXCEEDED** because the waiting time was much shorter than 12 hours.

Indicator 3.4.1.3.	**No oil/chemicals/contaminants/sewerage spills enter the Ramsar site.**			
Data Source	**Namport**			
Status:			**MET**	

No oil, chemicals, contaminants or sewerage spills entered the Ramsar site (lagoon) in 2017 because the port expansion now acts as a buffer that keeps spillages out of the lagoon.[23] This was confirmed by an internet search of the Namibian media for reports on spills, which did not turn up any results for the year 2017. The newspapers however reported an oil spill in March 2018 that washed ashore at Afrodite Beach, but did not affect the lagoon. It was traced to two ships anchored in the bay.

[21] Article in The Namibian of 14 February 2018
[22] Pers. comm. Namport, 2018
[23] Pers. comm. Namport, 2018

Motivation of status: No spills affected the Ramsar site, meaning that this indicator was **MET**.

Desired Outcome 3.5.	**Electricity is available and reliable.**			
Target 3.5.1.	**The public do not suffer disruptions in electricity supply as a result of uranium mining.**			
Indicator 3.5.1.1.	**No disruptions in electricity supply as a result of mining.**			
Data Source	**NamPower**			
Status:			**MET**	

Namibia's electricity consumption is strongly correlated to GDP growth. To address the increase in demand for electricity, and to complement NamPower's initiatives, the Ministry of Mines and Energy prepared a National Integrated Resource Plan for the next 20 years. The plan spells out the electricity generation projects Namibia could pursue to meet its growing electricity demand. MME further drafted the Renewable Energy Policy, the Independent Power Producer Policy, and the National Energy Policy. These policies will help the country towards realising energy security in the future.

In 2017, NamPower was able to consistently meet the electricity needs of all sectors of the economy. The availability of the transmission network and generation plants exceeded the planned target, as a result of continuous maintenance and improvement of the existing plants and transmission network. No significant interruptions in supply to the Erongo Region were reported. Investments in solar power boosted domestic power generation and led to a 6% decline in electricity imports from 63% to 57% in the financial year under review. This was achieved by integrating renewable energy into the grid through the renewable energy feed-in tariff (REFIT) programme. The import of electricity from regional partners will remain part of the energy supply mix until the realisation of a base-load power plant. NamPower continued encouraging independent power producers to bring their projects on board under the REFIT programme.[24]

Motivation of status: This indicator was **MET** because there were no disruptions in electricity supply as a result of mining in 2017.

Indicator 3.5.1.2.	**Industrial development is not delayed by electricity shortage.**			
Status:			**MET**	
Indicator 3.5.1.3.	**No investment decision deferred because of electricity shortage.**			
Data Source	**NamPower/Municipalities/Erongo Regional Council**			
Status:			**MET**	

[24] NamPower Annual Report 2017, www.nampower.com.na.

NamPower continues to supplement its energy requirements with imports from utilities in the Southern African Power Pool (SAPP). The availability and accessibility of surplus power from the region helps NamPower to secure power supply to its customers. The supply-demand balance in the region has changed significantly over the past decade due to a number of reasons, including economical slow-down in some of the neighbouring countries such as South Africa.[25]

However, countries in the region are focusing on developing domestic power generation capacity to close the forecasted gap between supply and demand, and NamPower is no exception. A number of import agreements will be expiring by 2020 and NamPower is gearing up to bring new local generation plants online to cover the anticipated supply gap. NamPower and Eskom signed a five-year power purchase agreement in March 2017 for the firm supply of 200 MW, supplementing its requirements with additional energy on day-ahead basis.

Motivation of status: These two indicators were **MET** because there was sufficient electricity available for investment and industrial development in the region.

Indicator 3.5.1.4.	**Electricity quality of supply meets ECB standard.**			
Data Source	**Electricity Control Board (ECB)/ErongoRED**			
Status:			**MET**	

The Erongo Regional Electricity Distributor known as Erongo RED is an institution tasked with the distribution and supply of electricity within the Erongo Region. Erongo RED had several planned and unplanned outages caused by the upgrade of the bulk power supply at Walvis Bay that was completed in 2017. The upgrade was necessary to prevent load shedding. NamPower partnered with Erongo RED to strengthen the supply infrastructure for the next 10 to 15 years. The project included the replacement of two 66 kV lines between the Kuiseb substation and Walvis Bay with two 132 kV lines; the upgrade of the Kuiseb substation and the construction of the new Paratus intake substation. A similar upgrade to international standards is planned for Swakopmund.[26]

The Electricity Control Board (ECB) confirmed that Erongo RED complied with their electricity supply and safety standards. The quality of supply aspect of technical performance plays an important role for the utility in ensuring that the revenue requirement is not lost through poor performance standards. Network losses play a major role amongst the distribution companies. Erongo RED outperformed other REDs, maintaining their losses below the allowed loss threshold. Erongo RED's performance of 9% in technical losses in relation to the benchmark standards is notable and will be continuously monitored under the existing licensee compliance system.[27]

Motivation of status: Based on the above information this indicator was **MET**.

[25] NamPower Annual Report 2017, www.nampower.com.na
[26] Pers. comm. Erongo RED 2017
[27] Electricity Control Board 2017 Annual Report

Indicator 3.5.1.5.	Electricity provision does not compromise human health.			
Data Source	NamPower/NUA			
Status:		IN PROGRESS		

NamPower has started to address the question whether electricity provision compromises human health. An air quality monitoring programme has been implemented at the Van Eck power station in Windhoek. A monitoring station for sulphur dioxide and particulate matter (PM10 and PM2.5) concentrations was established downwind and directly west of the power station. This was informed by predominant wind directions and simulated impact areas affected by power station operations.

Passive diffusers measuring sulphur dioxide (SO_2) and oxides of nitrogen (NO_x) were placed at various sampling sites around the power station. A PM sampler was placed at the NamPower Training Centre to monitor ambient dust from the Van Eck power station (Figure 15).[28]

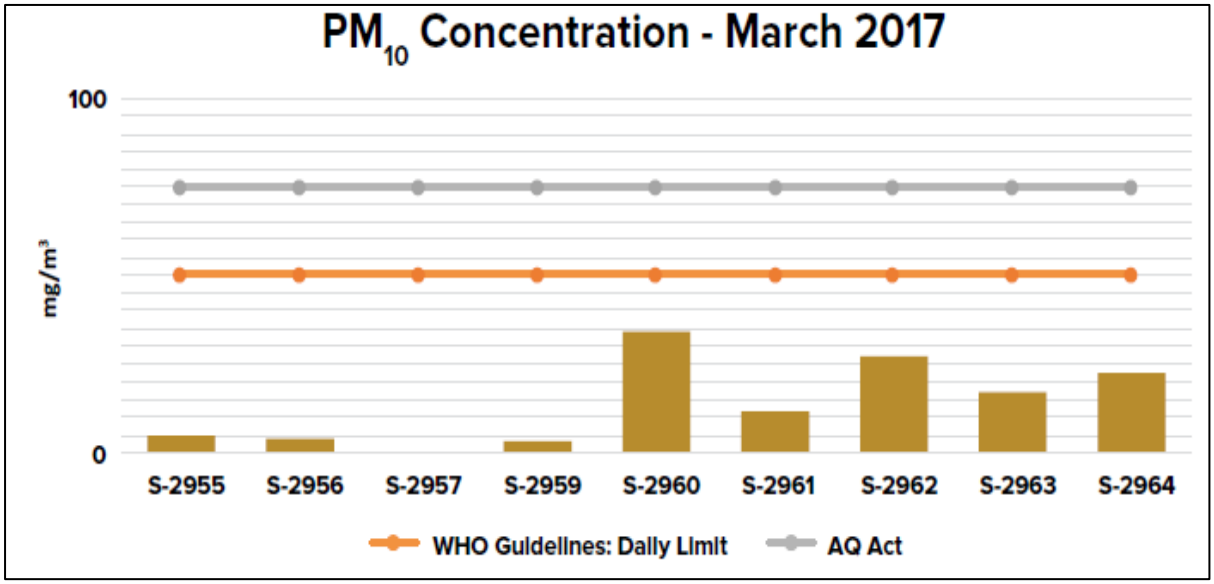

Figure 15: PM10 Dust Concentration at NamPower Training Centre in March 2017

More measurements are needed to better define the air quality impact of Van Eck and the additional contribution from traffic in the vicinity. Mitigation methods should then be developed, if necessary, to ensure that concentration levels remain within the local or World Health Organization air quality standards.

Motivation of status: NamPower has started monitoring the air quality at Van Eck power station to find out if local electricity generation had an effect on human health. The indicator was rated **IN PROGRESS** because more data are needed to reach a conclusion.

[28] NamPower Annual Report 2017, www.nampower.com.na

Indicator 3.5.1.6.	**Mines pursue renewable power supply options as far as possible.**
Data Source	**NUA/NamPower/ErongoRED**
Status:	**MET**

Renewable energy alternatives are gradually becoming more economic, especially if they are constructed to feed into the national supply network. During the year under review, NamPower supported the establishment of several solar power stations across the country and concluded power purchase agreements with the developers.[29] A photovoltaic power station located west of Arandis started feeding into Erongo RED's network, while another 5 MW PV station at Trekkopje Mine will be completed in mid-2018.

Some mining companies have investigated or applied renewable energy alternatives in 2017. Langer Heinrich Uranium has looked at the feasibility of a photovoltaic power plant and considered a range of options; however the current financial situation made it impossible to proceed with this project. Swakop Uranium has installed an on-site power station to capture waste heat from the acid plant, which is used to heat boilers and generate steam to turn turbines for electricity generation. The turbine however only came online in 2018 as Swakop Uranium was awaiting the required licence to operate the facility from the authorities. During 2017, the company started investigating the possibility of installing a solar power plant; this project is still in progress. Bannerman Mining Resources' demonstration plant operates partially on solar energy.

Motivation of status: This indicator was **MET** because renewable power supply options were pursued in 2017 and implemented at several sites.

Desired Outcome 3.6.	**Waste sites have adequate capacity.**
Target 3.6.1.	**All sewage, domestic and hazardous waste sites are properly designed and have sufficient capacity for the next 20 years, taking into account the expected volumes from mines and all associated industries.**
Indicator 3.6.1.1.	**Municipalities have sufficient capacity of sewage works and waste sites based on actual and predicted volumes of waste.**
Data Source	**Municipality of Walvis Bay and Swakopmund**
Status:	**MET**

The Walvis Bay Municipality reported that there is sufficient space for solid waste for more than 20 years.[30] The existing sewage treatment plant will be upgraded in 2018 to handle 11 000 m^3/day dur-

[29] NamPower 2017 Annual Report

[30] Information related to waste management at Swakopmund and Walvis Bay was provided by the Swakopmund Municipality and Walvis Bay Municipality, unless otherwise stated

ing the next five years. The EIA for the upgrade has been completed. An additional plant for the airport, army base and industrial area with a capacity of 6 000-8 000 m^3/day is planned for the future. The design of this plant will make provision for the option of treating effluent water to potable standard to be added at a later stage.

The Swakopmund Municipality relatively new sewage treatment plant has sufficient capacity for the future and the landfill site has enough space for at least 20 years.

Motivation of status: The indicator was **MET** because both municipalities confirmed that their landfills and sewage works have sufficient capacity based on actual and predicted waste volumes.

Indicator 3.6.1.2.	**Independent audits are undertaken for waste sites and findings are closed out.**			
Data Source	**Municipality of Walvis Bay and Swakopmund**			
Status:			**MET**	

In this indicator "independent audits" are defined to include government audits and inspections, as well as any other independent third-party audits, e.g. by consultants. Solid and liquid waste disposal sites at both municipalities were audited by representatives of the Auditor General and the Environmental Commissioner, while the Department of Water Affairs & Forestry of MAWF carried out annual inspections of the sewage treatment plants. The required wastewater and effluent disposal permits were in place.[31]

The Auditor General's performance audit report on sewerage management by local authorities in Namibia that was tabled in the National Assembly in July 2018 highlighted a lack of environmental management plans for existing sewerage infrastructure in the years up to 2015/16.[32] The municipalities have however been working on EMPs during the last two years and have applied for environmental clearances.

Mining companies that subscribe to product stewardship or the ISO 14001 system also audit the waste sites they use. When Rössing Uranium audited the hazardous waste disposal site at Walvis Bay in 2016 they found some shortcomings which made them stop the deposition of hazardous waste at the site. During the next audit they noticed major improvements and agreed to start using the facility again.[33] They reported that major shortcomings had been addressed in 2017, while a few actions were still in progress in 2018.

Waste management systems at uranium mines are also audited annually as part of the EMP commitments and ISO 14001 certification requirements. For instance, external consultants audited Swakop Uranium's waste transition yard and related management processes in November 2017 and did not raise any major findings.

Motivation of status: Independent audits and inspections were conducted in 2017 at the Walvis Bay and Swakopmund landfills and sewage plants and findings are being addressed. The indicator was **MET**.

[31] Swakopmund Municipality and Walvis Bay Municipality
[32] Article "Environment ministry fails in sewer management – Kandjeke" in The Namibian of 12 July 2018
[33] Pers. comm. Rössing Uranium, 2018

Indicator 3.6.1.3.	**All new waste sites undergo an EIA prior to construction and receive an environmental clearance certificate.**			
Data Source	**Municipality of Walvis Bay and Swakopmund/MET**			
Status:		**IN PROGRESS**		

An EIA for the upgrade of the Walvis Bay wastewater treatment plant has been completed. A recycling operator has carried out an EIA for a new recycling facility at Walvis Bay and obtained an environmental clearance certificate. Regarding existing waste sites, Section 5 (3) of the Environmental Management Act states: "Where a waste disposal site already exists in terms of any law, the Minister may approve that site as a waste disposal site for the purpose of this section." The approval process involves preparing an environmental management plan (EMP) and obtaining an environmental clearance certificate (ECC) from MET. The ECC is regarded as a "licence to operate" in terms of this indicator. Both Swakopmund and Walvis Bay municipalities confirmed that had compiled EMPs and applied for ECCs in 2017. The Swakopmund and Walvis Bay landfill sites did not obtain environmental clearance certificates in 2017.[34]

Motivation of status: Since EIAs for new projects have been completed and ECC applications for the existing landfills are under way the indicator has been rated **IN PROGRESS.**

Desired Outcome 3.7.	**Waste sites are properly managed.**			
Target 3.7.1.	**The management of waste sites meets national standards.**			
Indicator 3.7.1.1.	**Waste site managers are adequately trained (where managers have attended at least a one-week course in waste management at a reputable training institution).**			
Data Source	**Municipality of Walvis Bay and Swakopmund**			
Status:		**IN PROGRESS**		

The waste site managers at Swakopmund Municipality are qualified Environmental Health Practitioners, while the waste management contractor Envirofill is responsible for the training their personnel. At Walvis Bay Municipality, employees involved with wastewater treatment are trained as needed and overseen by a professional engineer. The solid waste foreman and inspector of hazardous waste have both been trained, but the contractor who is actually managing the solid waste site has not yet been trained.

Motivation of status: Municipal employees in charge of managing the waste sites are trained, but it was uncertain if contractors received adequate training. The outstanding verification of the contractor's training results in the indicator being **IN PROGRESS**.

[34] Pers. comm. MET, 2018

Indicator 3.7.1.2.	**Site manifests which record non-hazardous wastes, volumes and origins are kept.**			
Data Source	**Municipality of Walvis Bay and Swakopmund**			
Status:		**IN PROGRESS**		

The Walvis Bay landfill site has a weighbridge where weight, origin and type of refuse entering the landfill site are recorded. The Swakopmund Municipality does not yet have a weighbridge, but is planning to build one as this is one of MET's requirements before an ECC can be issued. Currently only records of the number of waste trucks dumping at the landfill are kept, while the recycling operator reports the tonnage of recycled materials.

Motivation of status: This indicator was rated as **IN PROGRESS** because adequate records of non-hazardous waste were kept at Walvis Bay, while Swakopmund was planning to build a weighbridge to enable proper record-keeping.

Indicator 3.7.1.3.	**Only hazardous waste classes for which the sites are licensed are accepted.**			
Data Source	**Municipality of Walvis Bay and Swakopmund**			
Status:			**MET**	

As mentioned under indicator 3.6.1.3, licensing of the Walvis Bay hazardous waste facility, which is the only one in the coastal area, is still in progress. The Municipality confirmed that the facility has from the start only accepted those hazardous waste classes for which it expects to be licensed. Arrangements have to be made with the hazardous waste inspector before any incoming load is accepted.

Motivation of status: Only pre-approved hazardous waste in line with the expected licence conditions is accepted at the Walvis Bay hazardous waste site, the indicator was therefore **MET**.

Indicator 3.7.1.4.	**Water and air quality monitoring data at waste disposal sites show no non-compliance readings.**			
Data Source	**Municipality of Walvis Bay and Swakopmund**			
Status:		**IN PROGRESS**		

Water quality monitoring at waste disposal sites will form part of the waste management EMPs once they are in place. The municipalities of Walvis Bay and Swakopmund reported that this issue has been mentioned in audits and they were considering the establishment of monitoring boreholes or trenches. Waste burning is prohibited on both landfills, but Walvis Bay does operate a small incinerator for medical waste.

The air quality at both towns is now being monitored as part of the Ministry of Mines and Energy's advanced air quality study. Measured parameters include weather conditions, including inhalable dust (PM_{10}) and very fine particulates that result from burning ($PM_{2.5}$). The results are compared to the World Health Organization (WHO) Interim Target 3 that allows PM_{10} concentrations of up to 75 micrograms per cubic metre ($\mu g/m^3$) and $PM_{2.5}$ concentrations of up to 37.5 $\mu g/m^3$, which may both be exceeded only three times per year. More relevant standards that are specific to the Erongo Region are currently being developed as part of GSN's advanced air quality study. This is necessary due to the local climate with generally high wind speeds experienced at the coast and occasional berg winds with sandstorms in winter.

More information about the air quality study can be found under EQO 5 Air Quality. The data obtained so far show that the readings for Swakopmund and Walvis Bay remained below the WHO limit for $PM_{2.5}$, while the PM_{10} dust levels exceeded the WHO limit more than three times. The study consultants found that the natural environment was the main source of the $PM_{2.5}$ and PM_{10} dust.[35] What is important for the assessment of this indicator is that the $PM_{2.5}$ data did not show excessive fine particle pollution from the burning of waste or other sources.

Water quality monitoring is probably less important because the low rainfall at the coast reduces the possibility that leachates will emanate from the landfills and affect the groundwater quality. The Swakopmund Municipality reported that they did not observe any leachates coming from the old landfill site while it was still in operation or afterwards. The impact of leachates, if any, on the water quality would be minimal because the receiving groundwater is saline[36]. At Walvis Bay there could however be hydrocarbon pollution of seawater if oil discharged on the landfill infiltrated down to the water table and reached the ocean. The first set of monitoring results should show if this is the case, provided that the samples are analysed for hydrocarbons.

Motivation of status: This indicator was rated **IN PROGRESS** because air quality monitoring is in place and water quality monitoring is expected to start once ECCs have been issued.

Indicator 3.7.1.5.	**Municipalities comply with the site licence requirements relating to pollution control.**			
Data Source	**Municipality of Walvis Bay and Swakopmund**			
Status:		**IN PROGRESS**		

Both municipalities confirmed that they will receive sufficient funding to manage waste in accordance with their EMPs, once these are approved. In 2017, they only had effluent disposal permits; neither Swakopmund nor Walvis Bay had licences for their landfills.

Motivation of status: Seeing that effluent disposal permits were in place and endowed with sufficient funding, and that the application process for landfill ECCs had started the indicator was rated **IN PROGRESS**.

[35] Liebenberg-Enslin, H (2017): Advanced Air Quality Management for the Strategic Environmental Management Plan for the Uranium and Other Industries in the Erongo region: Ambient Air Quality Monitoring Report for the Period 1 November 2016 to 30 April 2017. Report No.: 16MME01-2 Public Report

[36] Christelis, G and W Struckmeier (2001): Groundwater in Namibia - An Explanation to the Hydrogeological Map. Department of Water Affairs, MAWF, Windhoek

Target 3.7.2.	**The management of mines' mineral waste sites (tailings and waste rock facilities) meets national standards.**
Indicator 3.7.2.1.	**Effluents from mineral waste sites are managed in compliance with DWAF industrial effluent exemption permit conditions.**
Data Source	**DWAF**
Status:	**MET**

Mineral waste produced during mining consists of waste rock, which includes overburden and low-grade ore with a uranium content that is below the cut-off grade. The metallurgical process generates tailings, i.e. the leached ore that remains behind after the uranium has been removed. Mineral waste stays on the mine sites, either in form of waste rock dumps or as backfill material in pits or in a tailings storage facility.

The environmental impact of mine waste depends on its type and composition, which vary considerably with the commodity being mined, type of ore, and technologies used to process the ore. Every mine requires its own waste characterization, prediction, monitoring, control and treatment. The major environmental impacts from waste disposal at mine sites can be divided into two categories: the loss of land (and biodiversity) following its conversion to a waste storage area, and the introduction of sediment, acid and other process chemicals, as well as radioactive contaminants into surrounding surface and groundwater from water running over and/or seeping through chemically reactive wastes. These processes continue long after a mine has closed and have to be controlled. At most mines waste dumps and tailings storage facilities will remain as permanent features that need to be stabilised and integrated in the landscape.

Environmental management plans are designed to avoid or mitigate the environmental impacts resulting from the construction and operation of waste disposal facilities, as well as long-term liabilities after mine closure. They include measures to manage the impact of effluents on the ambient water quality and the control of radioactive emissions. Mines use standard operating procedures and plans to ensure that the waste disposal methodology complies with environmental regulations and good engineering practice, e.g. in terms of stability.

The application of these procedures is verified through inspections and audits (first, second and third party). Records of mineral waste volumes are kept and documented for reporting to the relevant authorities. Target 3.2.7 requires that the management of mines' mineral waste sites (tailings and waste rock facilities) meets the national standards. Four indicators cover the areas of concern and are assigned to the relevant authorities.

Indicator 3.7.2.1 is intended to ensure that mines manage effluents from mineral waste sites in compliance with DWAF effluent disposal exemption permit conditions. The purpose of the DWAF industrial effluent disposal exemption permit is to manage the impact of effluents from waste facilities on the ambient surface and groundwater quality. DWAF inspectors do not issue non-compliance reports, but write "letters of irregularities" if shortcomings are observed during mine inspections. No such letters were issued in 2017. [37]

[37] Pers. comm. DWAF, 2018

Langer Heinrich Uranium reported that conditions are stipulated in the wastewater and effluent disposal exemption permit and were adhered to during this reporting period. Rössing Uranium's permit does not prescribe mineral waste management activities. The company therefore uses emission criteria derived from site-specific conditions applying air and water quality risk-based site-specific targets and Rio Tinto management processes. Rössing Uranium's permit requires that industrial effluents, including tailings solution, are recycled and that the groundwater quality at certain boreholes has to be monitored. The company complied with these permit conditions. During 2017, Swakop Uranium finalised the application for an industrial effluent exemption permit for operations, including mineral waste sites, which was submitted to DWAF in early 2018. Management of the mineral waste facilities and related infrastructure was conducted in line with EMP commitments.

Motivation of status: The indicator was **MET** because operating mines complied with their permit conditions.

Indicator 3.7.2.2.	**Management of waste sites complies with NRPA regulations.**
Data Source	**NRPA**
Status:	**MET**

The National Radiation Protection Authority (NRPA) requires mines to implement a radiation management plan (RMP) to *inter alia* control radioactive emissions from mineral waste sites. Companies have to prepare annual reports on the implementation of the RMP. The Authority's inspectors review the annual reports and visit the mines to ensure that the RMPs are implemented in practice. The operating mines and projects submitted their 2017annual reports and the NRPA did not encounter any issues related to mineral waste management during inspections. [38]

Motivation of status: The indicator was **MET** because the NRPA did not issue any non-compliance reports related to the management of mineral waste sites in 2017.

Indicator 3.7.2.3.	**Management of waste sites complies with approved EMP.**
Data Source	**MET**
Status:	**MET**

The Ministry of Environment and Tourism evaluates and approves EMPs including provisions for the mitigation of environmental impacts resulting from the construction and operation of waste disposal facilities, as well as long-term liabilities after mine closure. Currently, there are no regulations under the Environmental Management Act that would enable MET to issue fines. MET uses a system of 1) compliance notifications as warnings to allow operations time to acquire an ECC or to remedy impacts following the EIA process; and 2) compliance orders to stop operations for failure to comply with either a compliance notification or an EMP. No compliance orders were issued in 2017.[39]

[38] Pers. comm. NRPA, 2018
[39] Pers. comm. MET:DEA, 2018

All operating mines and active exploration projects were covered by valid environmental clearance certificates and submitted the required biannual reports on the status of the environment. Langer Heinrich Mine's environmental clearance certificates (ECC) were renewed for a period of three years. Langer Heinrich Uranium reported that a detailed and approved EMP was in place and internal audits on the implementation of EMP commitments carried out. An ISO 14001 audit was carried out to measure compliance with the commitments, standards and legal requirements that formed part of the audit programme, i.e. the whole of the EMP was audited.

Rössing Uranium also confirmed compliance with the MET-approved EMP. EMP and permit compliance checks form part of the ISO 14001 environmental management system auditing process at the operating mines. Swakop Uranium maintains a detailed approved EMP with applicable procedures, which is in place for Husab Mine's activities. Internal compliance inspections and audits were carried out to measure compliance with the commitments, standards and legal requirements. The Husab mine is currently IMS certified (ISO14001:9001:OSHAS 18001) for Mining (2016) and Processing (2017).

Motivation of status: The indicator was **MET** because the Ministry of Environment and Tourism did not issue any compliance orders to uranium mines in 2017.

Indicator 3.7.2.4.	**Management of waste sites complies with approved closure plan.**			
Data Source	**MME/MET**			
Status:			**MET**	

High-level closure plans are usually included in mining companies' EMPs, which are reviewed and approved by the Ministry of Environment and Tourism. This is the case at Langer Heinrich Mine whose EMP with closure commitments was submitted for the application of an environmental clearance certificate. In addition a Closure Management Plan exists, which is reviewed and updated periodically.

Rössing Uranium has a Closure Management Plan with the following provisions for mineral waste facilities: The tailings storage facility will be capped with rock to prevent wind and water erosion, the waste rock dumps will be shaped to blend into the natural landscape and a fine-grained layer to prevent rainwater infiltration and promote vegetation growth will be applied at the end of waste rock deposition. This plan has been approved as part of the EMP for the mine.

Compilation of a Mine Closure Plan for Swakop Uranium commenced in 2017 and is nearing completion. Therefore, the current EMP still makes provision for closure measures stated therein from the 2013 EIA process. The EMP will subsequently be updated to include any additional closure commitments.

It should be noted that closure planning is a highly specialised field that involves modelling of the long-term behaviour of mineral waste facilities and evaluation of the risk that these facilities might pose to the environment. It is thus important that both mines and Government agencies employ experts in the compilation and review of mine closure plans.

Motivation of status: The indicator was **MET** because mines are managing their waste sites in compliance with approved closure plans. It should however be noted that the closure plans contained in EMPs approved by the Ministry of Environment and Tourism are high-level outlines that do not allow a critical review of the risks related to the long-term management of mineral waste facilities.

Desired Outcome 3.8.	**Recycling is common practice in the Central Namib.**			
Target 3.8.1.	**A sustainable waste recycling system is operational in the Central Namib, servicing the uranium mines and the public.**			
Indicator 3.8.1.1.	**A waste recycling depot is established.**			
Data Source	**Municipality of Walvis Bay and Swakopmund**			
Status:			**MET**	

A contractor has established a recycling facility next to the Swakopmund landfill in 2015. The municipality has distributed orange waste bins for recyclable materials to households in many parts of town that are emptied weekly. The system will be rolled out to other areas together with an awareness campaign. The municipality has also registered recyclers who are working on the landfill, equipped them with personal protective equipment and is planning to assist them with marketing of the reclaimed materials. The Wards Cleaning Project that employs local people to clean public open spaces has also resulted in additional volumes of recyclable materials being collected.

The Walvis Bay Municipality has entered into an agreement with a waste recycler to establish a depot next to the landfill in 2017. They have 30 registered recyclers who specialise in certain waste types, some collecting wood, some metal, some glass; that are then weighed and sold to recycling companies.

Mining companies also employ functioning waste management systems to reduce the volume of waste that would otherwise be taken to municipal landfills. Rössing Uranium uses a contractor to provide integrated waste management services because minimising the volume of waste to landfill is not only eco-friendly, but also reduces cost. It is essential that all recyclable material, e.g. waste oil, scrap metal, wood and paper is removed from the general waste stream at source. Langer Heinrich and Husab mines use similar systems, practising recycling as per approved EMP and procedure requirements. The recyclable materials are taken to the relevant recycling facilities or depots.[40]

Motivation of status: This indicator was **MET**, because sustainable waste recycling systems were in place at Swakopmund, Walvis Bay and the operating mines in 2017.

Indicator 3.8.1.2.	**Waste recycling operators have sufficient capacity to collect, transport and recycle waste in a safe and responsible manner.**			
Data Source	**Municipality of Walvis Bay and Swakopmund**			
Status:			**MET**	

As reported above both municipalities are using registered recyclers and recycling companies who have sufficient capacity to collect, transport and recycle waste in a safe and responsible manner.

[40] NUA input to 2017 SEMP Report

The waste recycling contractors employed at operating mines also provide the required capacity and safe handling.

Motivation of status: This indicator was rated as **MET** because waste recycling operators in the region had sufficient capacity to collect, transport and recycle waste in a safe and responsible manner.

Indicator 3.8.1.3.	**Volume of waste disposed to landfill per capita decreases.**			
Data Source	**Municipality of Walvis Bay and Swakopmund**			
Status:			**MET**	

The Walvis Bay Municipality provided data from 2005/06 to 2015/16 (their financial year runs from July to June) that illustrate how waste volumes fluctuated in response to building and industrial activities. The percentage of waste recycled from the landfill varied between 2.2% and 4.7% with an average of 2.9%. This excludes recyclable materials picked up at source. To determine the mass of waste per capita census figures for 1991, 2001, 2011 and 2016 were used to interpolate the average population growth for each year. The actual (shown in **bold**) and estimated figures for the period 2005/06 to 2015/16 are listed in Table 9. The population of Walvis Bay doubled during this time, with accelerated growth between 2011 and 2016. Dividing the annual waste tonnage by the number of residents shows an impressive reduction in waste per capita from 1.0 t during the first 5 years to 0.6 t in 2015/16, i.e. a decrease by 40%.

Table 9: Walvis Bay Waste Per Capita

Year	Total waste (t)	Population	t per capita
2005/06	53669	52850	1.0
2006/07	61694	54700	1.1
2007/08	57854	56550	1.0
2008/09	58647	58400	1.0
2009/10	58208	60250	1.0
2010/11	55867	**62100**	0.9
2011/12	54729	69680	0.8
2012/13	53114	77260	0.7
2013/14	46697	84840	0.6
2014/15	64904	92420	0.7
2015/16	64616	**100000**	0.6

The Swakopmund Municipality indicated that the recycling facility has resulted in significantly reduced final disposal volumes. Actual figures kept by the waste management contractor were however not available.

Motivation of status: Recycling has reduced the waste-to-landfill volumes per capita for Walvis Bay by 40% and a similar reduction can be assumed for Swakopmund based on observation of the contractor's operations.[41] The indicator was **MET**.

[41] Pers. comm. NUA, 2018

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Summary of performance: EQO 3

Total no. indicators assessed: 34 (1 was **NOT APPLICABLE**)

	NOT MET	IN PROGRESS	MET	EXCEEDED
Number of indicators in class	1	8	24	1
Percent of indicators in class	3%	24%	71%	3%

Overall performance: The infrastructure EQO covers housing, transportation including roads, railways and harbour, electricity supply and renewable energy, as well as waste management and recycling. The two housing indicators continued to be **MET** because mining companies do not intend to establish on-site hostels or mine-only townships. Four indicators referring to road condition and maintenance were **MET** and two were **IN PROGRESS**, while one (safe traffic on the B2 road) was **NOT MET**. The indicator for the reduction of heavy traffic on the road between Swakopmund and Walvis Bay was **NOT APPLICABLE**. The indicator of rail use for bulk goods was **MET**, while Namport's three indicators were **MET** or **EXCEEDED**. The indicators concerning the quantity and quality of electricity supply to the region and the implementation of renewable energy projects at mines were mostly **MET**, only the indicator on the health impact of local electricity generation was **IN PROGRESS**. Ten waste management indicators were **MET** and five were **IN PROGRESS**. Among these, all four indicators that check the mines' compliance with regulatory requirements for the management of mineral waste were **MET**.

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EQO 4. Water

Aims of this EQO: To ensure that the public have the same or better access to water in future as they have currently, and that the integrity of all aquifers remains consistent with the existing natural and operational conditions (baseline). This requires that both the quantity and quality of groundwater are not adversely affected by prospecting and mining activities.

Underground water plays an important role in the sustainable development of the country. This resource is utilized in towns and communal areas, in industries, mining and agriculture, and is an integral part of a functioning ecosystem. Namibia relies much on runoff from rainfall that is either caught in dams or flows along ephemeral rivers and infiltrates into the ground to form aquifers. The Water EQO aims to assure the quality and quantity of water that is available to the public in the Erongo Region. Key stakeholders in this EQO are the Department of Water Affairs and Forestry (DWAF) of the Ministry of Agriculture, Water and Forestry (MAWF) as the regulator, NamWater as the bulk-supplier and distributor, and the towns and mining industry as major consumers.

Monitoring of groundwater in the Central Namib uranium province is undertaken with the aid of 15 boreholes along the Swakop and Khan rivers. In fulfilling the monitoring responsibility, DWAF carries out an annual borehole sampling campaign, while NamWater monitors the quality of potable water supplied to the coastal towns, mines and small consumers. Data for this EQO were supplied by NamWater and by a consulting company on behalf of GSN and DWAF, while the mining industry contributed water level data for the Swakop and Khan rivers.

Desired Outcome 4.1.	**Water for urban and rural communities is of acceptable quality.**			
Target 4.1.1.	**Uranium mining does not compromise community access to water of appropriate quality.**			
Indicator 4.1.1.1.	**Potable water conforms to minimum required quality as prescribed in the national water quality standards.**			
Data Source	**DWAF**			
Status			**MET**	

The monitoring scope as defined in this target includes water supplied to urban users in Arandis, Henties Bay, Swakopmund and Walvis Bay, as well as farmers on smallholdings along the lower Swakop River.

Water quality monitoring involves the analysis of physical parameters, major anions and cations, trace elements and radionuclides, depending on expertise and finances available in the monitoring institution. The first two indicators of this EQO focus on the quality of water that is supplied to urban users, communal and commercial farmers. To find out if the desired outcome of acceptable water quality was achieved NamWater supplied the results of drinking water analyses carried out at their laboratory in Windhoek, which were then compared to the Namibian guideline values.

Chemical Analyses of Drinking Water

The chemical analyses of samples taken at Henties Bay, Swakopmund and Walvis Bay in 2017 are presented in the following tables. The results confirmed that the chemical quality of the water was good (Group B) to excellent (Group A) and suitable for human consumption (the Namibian Water Quality Standards are shown in **Error! Reference source not found.** in the Appendix for comparison).

Table 10: Chemical Analysis of the NamWater Supply to Swakopmund and Arandis

Determinant	Units	Aug-17	Aug-17	Jul-17	May-17	Apr-17	Mar-17	Feb-17
pH		8.6	8.1	7.8	8.0	7.9	7.8	8.1
Turbidity in NTU	NTU	0.28	1.57	0.45	0.18	0.34	1.01	0.42
Conductivity mS/m	mS/m	112	113	105	96	134	172	151
TDS calculated	mg/L	749	758	706	644	900	1150	1010
Sodium	mg/L	162	153	136	120	210	270	212
Potassium	mg/L	8	7	6	8	9	12	7
Calcium as CaCO3	mg/L	58	68	83	115	105	103	155
Magnesium as CaCO3	mg/L	58	50	46	46	63	100	88
Sulphate	mg/L	34	39	32	42	54	72	71
Nitrate as N	mg/L	0.5	0.8	<0.5	1.3	1.5	1.5	2.4
Silica	mg/L	<1	<1	3	6	9	9	13
Fluoride	mg/L	0.1	0.1	0.2	0.2	0.2	0.2	0.3
Chloride	mg/L	285	250	224	204	330	455	345
Alkalinity as CaCO3	mg/L	46	56	90	98	82	74	126
Iron	mg/L	<0.01	-	0.02	<0.01	0.01	0.01	<0.01
Manganese	mg/L	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	mg/L	<0.01	-	<0.01	<0.01	0.01	0.04	0.03
Zinc	mg/L	<0.01	-	0.01	<0.01	0.01	0.02	0.01
Cadmium	mg/L	<0.01	-	<0.01	<0.01	<0.01	0.01	0.02
Lead	mg/L	<0.02	-	<0.02	<0.02	<0.02	0.01	<0.02

In 2017, drinking water supplied to Swakopmund and Arandis consisted of a mix of desalinated water from the Erongo desalination plant and groundwater from the Omdel and Kuiseb River wellfields. The physical and chemical parameters as shown in Table 10 confirmed its good quality (Group B). The total dissolved solids (TDS) concentration of the mixed water was 644-758 milligrams per litre (mg/L) in May to August, while the higher TDS values in February-April indicate that the proportion of Omdel groundwater was higher than that of desalinated water.

In terms of heavy metals, the NamWater laboratory analyses iron, manganese, copper, zinc, cadmium and lead, but does not have a method to determine uranium in water.[42] The metal concentrations were mostly at or below the detection limit of 0.01-0.02 mg/L, except for 0.03-0.04 mg/L of copper at Swakopmund in February and March. The Walvis Bay supply also contained 0.03 mg/L copper and 0.03 mg/L zinc in February. The samples from Henties Bay showed 0.03 mg/L zinc in February and August 2017.

[42] The towns' drinking water is pumped from the Kuiseb and Omaruru rivers where there is no uranium mining, it is therefore not possible for uranium from the mines to enter the potable water supply.

The Kuiseb River groundwater that is supplied to Walvis Bay (Table 11) is less saline than Omdel water with a near-constant TDS concentration around 790 milligrams per litre and often excellent quality (Group A). The water supplied from Omdel to Henties Bay was of good quality (Group B) (Table 12 on the next page).

Table 11: Chemical Analysis of the NamWater Supply to Walvis Bay

Determinant	Units	Oct-17	Jul-17	May-17	May-17	Apr-17	Feb-17	Feb-17
pH		7.9	7.9	8.2	8.0	8.1	8.1	8.4
Turbidity in NTU	NTU	1.15	0.51	0.97	1.15	0.85	0.85	1.84
Conductivity mS/m	mS/m	118	117	119	118	113	118	118
TDS calculated	mg/L	793	782	795	789	760	793	792
Sodium	mg/L	113	106	106	105	102	115	110
Potassium	mg/L	16	13	20	19	14	16	12
Calcium as CaCO3	mg/L	245	220	248	243	223	205	233
Magnesium CaCO3	mg/L	142	138	150	142	129	121	138
Sulphate	mg/L	175	158	169	169	167	167	161
Nitrate as N	mg/L	4.7	3.9	4.6	4.8	5	5.1	4.9
Silica	mg/L	29	31	32	32	32	32	32
Fluoride	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chloride	mg/L	136	128	136	131	137	143	137
Alkalinity as CaCO3	mg/L	228	274	268	276	232	230	246
Iron	mg/L	<0.01	0.01	<0.01	<0.01	0.02	<0.01	<0.01
Manganese	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Copper	mg/L	0.01	<0.01	0.01	<0.01	0.01	0.02	0.03
Zinc	mg/L	<0.01	0.01	0.02	<0.01	0.01	0.02	0.03
Cadmium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02

Microbiological Analyses of Drinking Water

Microbiological testing of drinking water determines the three parameters heterotrophic plate count, coliform bacteria and faecal coliform bacteria. The heterotrophic plate count is an analytical method used to measure the variety of bacteria that are common in water. The concentration of bacteria shows whether the water system is well maintained.

Increases in heterotrophic plate count are due to the re-growth of bacteria in tanks and plumbing, and do not necessarily indicate the existence of a health risk, if the entry water meets the microbial water quality norms and contamination from outside is prevented. To consider water as very safe for human consumption (Group A) the total plate count may not exceed 100 colony-forming units per millilitre (cfu/mL) and faecal coliforms such as *Escherichia coli* (*E. coli*) must be absent in 100 mL in 95% of the samples. A heterotrophic plate count exceeding 1000 cfu/mL results in a classification of Group C - water with a risk factor which requires rectification (the water supply system must be disinfected with chlorine).

Coliform bacteria are commonly found in the environment (soil and vegetation) and are generally harmless. If only total coliform bacteria are detected, the source is probably environmental rather than faecal. Faecal coliforms (*E. coli*) indicate faecal pollution by warm-blooded animals or humans,

which implies the potential presence of waterborne pathogens. The results of a single sample are considered inadequate to evaluate the water quality. An evaluation should be based on the examination of a series of samples collected over a long period of time. If the guideline values are exceeded in one sample, a second sample should be taken from the same source as soon as possible.[43]

Table 12: Chemical Analysis of the NamWater Supply to Henties Bay

Determinant	Units	Oct-17	Aug-17	Jul-17	May-17	Apr-17	Feb-17
pH		8.0	8.0	7.8	7.9	8.0	8.0
Turbidity in NTU	NTU	0.33	0.37	0.21	0.29	0.31	0.35
Conductivity mS/m	mS/m	127	125	139	128	139	133
TDS calculated	mg/L	852	839	933	858	933	893
Sodium	mg/L	159	164	170	163	194	179
Potassium	mg/L	10	10	9	12	10	6
Calcium as CaCO3	mg/L	148	153	153	155	165	153
Magnesium CaCO3	mg/L	83	83	92	79	92	83
Sulphate	mg/L	59	58	59	59	65	62
Nitrate as N	mg/L	1.5	3.5	2.2	2.9	3.5	3.6
Silica	mg/L	8	23	23	23	25	23
Fluoride	mg/L	0.6	0.5	0.5	0.7	0.6	0.6
Chloride	mg/L	235	240	255	230	305	270
Alkalinity as CaCO3	mg/L	160	162	200	188	160	166
Iron	mg/L	0.01	<0.01	0.02	<0.01	0.01	<0.01
Manganese	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	mg/L	0.01	<0.01	0.01	<0.01	0.01	0.1
Zinc	mg/L	<0.01	0.03	0.02	<0.01	0.01	0.03
Cadmium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Lead	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	0.02

The results in Table 13, Table 14 and Table 15 show that the water supplied to the coastal towns was very safe. Heterotrophic plate counts (indicating the number of bacteria present), coliform bacteria and faecal coliforms were all below the limits of water quality Group A.

Table 13: Microbiological Analyses of the NamWater Supply to Henties Bay

Sampled	Town	Heterotrophic plate count	Coliforms	Faecal coliforms	Quality
2/7/2017	Henties Bay		Not detected	Not detected	A
4/11/2017	Henties Bay		Not detected	Not detected	A
5/23/2017	Henties Bay	Not detected	Not detected	Not detected	A
7/11/2017	Henties Bay		Not detected	Not detected	A
8/30/2017	Henties Bay		Not detected	Not detected	A
10/27/2017	Henties Bay		Not detected	Not detected	A

[43] Analytical Laboratory Services – Microbiological Analysis Report Form

Table 14: Microbiological Analyses of the NamWater Supply to Swakopmund

Sampled	Town	Heterotrophic plate count	Coliforms	Faecal coliforms	Quality
1/9/2017	Swakopmund	9	Not detected	Not detected	A
1/16/2017	Swakopmund	3	Not detected	Not detected	A
1/23/2017	Swakopmund	3	Not detected	Not detected	A
1/31/2017	Swakopmund	Not detected	Not detected	Not detected	A
2/6/2017	Swakopmund	1	Not detected	Not detected	A
2/8/2017	Swakopmund		Not detected	Not detected	A
2/13/2017	Swakopmund	2	Not detected	Not detected	A
2/20/2017	Swakopmund	1	Not detected	Not detected	A
2/27/2017	Swakopmund	5	Not detected	Not detected	A
3/6/2017	Swakopmund	8	Not detected	Not detected	A
3/13/2017	Swakopmund	Not detected	Not detected	Not detected	A
3/27/2017	Swakopmund	2	Not detected	Not detected	A
4/3/2017	Swakopmund	5	Not detected	Not detected	A
4/10/2017	Swakopmund	1	Not detected	Not detected	A
4/18/2017	Swakopmund	2	Not detected	Not detected	A
4/24/2017	Swakopmund	3	Not detected	Not detected	A
5/8/2017	Swakopmund	3	Not detected	Not detected	A
5/15/2017	Swakopmund	2	Not detected	Not detected	A
5/22/2017	Swakopmund	12	Not detected	Not detected	A
5/22/2017	Swakopmund	2	Not detected	Not detected	A
5/29/2017	Swakopmund	1	Not detected	Not detected	A
6/5/2017	Swakopmund	Not detected	Not detected	Not detected	A
6/12/2017	Swakopmund	9	Not detected	Not detected	A
6/19/2017	Swakopmund	Not detected	Not detected	Not detected	A
6/26/2017	Swakopmund	5	Not detected	Not detected	A
7/3/2017	Swakopmund	2	Not detected	Not detected	A
7/10/2017	Swakopmund	80	Not detected	Not detected	A
7/12/2017	Swakopmund		Not detected	Not detected	A
7/17/2017	Swakopmund	Not detected	Not detected	Not detected	A
7/24/2017	Swakopmund	Not detected	Not detected	Not detected	A
7/31/2017	Swakopmund	5	Not detected	Not detected	A
8/7/2017	Swakopmund	6	Not detected	Not detected	A
8/14/2017	Swakopmund	2	Not detected	Not detected	A
8/21/2017	Swakopmund	3	Not detected	Not detected	A
8/28/2017	Swakopmund	5	Not detected	Not detected	A
9/4/2017	Swakopmund	Not detected	Not detected	Not detected	A
9/11/2017	Swakopmund	Not detected	Not detected	Not detected	A
9/25/2017	Swakopmund	Not detected	Not detected	Not detected	A
10/2/2017	Swakopmund	Not detected	Not detected	Not detected	A
10/9/2017	Swakopmund	2	Not detected	Not detected	A
10/23/2017	Swakopmund	7	Not detected	Not detected	A
10/30/2017	Swakopmund	Not detected	Not detected	Not detected	A
11/6/2017	Swakopmund	42	Not detected	Not detected	A
11/13/2017	Swakopmund	Not detected	Not detected	Not detected	A
11/20/2017	Swakopmund	1	Not detected	Not detected	A
11/27/2017	Swakopmund	Not detected	Not detected	Not detected	A
12/4/2017	Swakopmund	Not detected	Not detected	Not detected	A
12/12/2017	Swakopmund	2	Not detected	Not detected	A

Table 15: Microbiological Analysis of the NamWater Supply to Walvis Bay

Sampled	Town	Heterotrophic plate count	Coliforms	Faecal coliforms	Quality
1/9/2017	Walvis Bay	2	Not detected	Not detected	A
1/16/2017	Walvis Bay	Not detected	Not detected	Not detected	A
1/23/2017	Walvis Bay	1	Not detected	Not detected	A
1/31/2017	Walvis Bay	1	Not detected	Not detected	A
2/6/2017	Walvis Bay	1	Not detected	Not detected	A
2/13/2017	Walvis Bay	Not detected	Not detected	Not detected	A
2/20/2017	Walvis Bay	Not detected	Not detected	Not detected	A
3/6/2017	Walvis Bay	1	Not detected	Not detected	A
3/13/2017	Walvis Bay	Not detected	Not detected	Not detected	A
3/27/2017	Walvis Bay	1	Not detected	Not detected	A
4/3/2017	Walvis Bay	3	Not detected	Not detected	A
4/10/2017	Walvis Bay	Not detected	Not detected	Not detected	A
4/18/2017	Walvis Bay	Not detected	Not detected	Not detected	A
4/24/2017	Walvis Bay	1	Not detected	Not detected	A
5/8/2017	Walvis Bay	Not detected	Not detected	Not detected	A
5/15/2017	Walvis Bay	Not detected	Not detected	Not detected	A
5/22/2017	Walvis Bay	2	Not detected	Not detected	A
5/22/2017	Walvis Bay	45	Not detected	Not detected	A
5/29/2017	Walvis Bay	7	Not detected	Not detected	A
6/5/2017	Walvis Bay	1	Not detected	Not detected	A
6/12/2017	Walvis Bay	1	Not detected	Not detected	A
6/19/2017	Walvis Bay	Not detected	Not detected	Not detected	A
6/26/2017	Walvis Bay	Not detected	Not detected	Not detected	A
7/3/2017	Walvis Bay	Not detected	Not detected	Not detected	A
7/10/2017	Walvis Bay	2	Not detected	Not detected	A
7/17/2017	Walvis Bay	Not detected	Not detected	Not detected	A
7/24/2017	Walvis Bay	Not detected	Not detected	Not detected	A
7/31/2017	Walvis Bay	Not detected	Not detected	Not detected	A
8/7/2017	Walvis Bay	Not detected	Not detected	Not detected	A
8/15/2017	Walvis Bay	Not detected	Not detected	Not detected	A
8/21/2017	Walvis Bay	4	Not detected	Not detected	A
8/28/2017	Walvis Bay	Not detected	Not detected	Not detected	A
9/4/2017	Walvis Bay	5	Not detected	Not detected	A
9/11/2017	Walvis Bay	Not detected	Not detected	Not detected	A
9/18/2017	Walvis Bay	1	Not detected	Not detected	A
9/25/2017	Walvis Bay	Not detected	Not detected	Not detected	A
10/2/2017	Walvis Bay	Not detected	Not detected	Not detected	A
10/9/2017	Walvis Bay	Not detected	Not detected	Not detected	A
10/16/2017	Walvis Bay	Not detected	Not detected	Not detected	A
10/23/2017	Walvis Bay	Not detected	Not detected	Not detected	A
10/30/2017	Walvis Bay	Not detected	Not detected	Not detected	A
11/6/2017	Walvis Bay	1	Not detected	Not detected	A
11/13/2017	Walvis Bay	Not detected	Not detected	Not detected	A
11/20/2017	Walvis Bay	Not detected	Not detected	Not detected	A
11/27/2017	Walvis Bay	Not detected	Not detected	Not detected	A
12/4/2017	Walvis Bay	Not detected	Not detected	Not detected	A
12/12/2017	Walvis Bay	1	Not detected	Not detected	A

Motivation of status: The water that NamWater supplied to Henties Bay, Arandis, Swakopmund and Walvis Bay complied with the national water quality standards and was of good to excellent quality. The indicator was therefore **MET**.

Target 4.1.2.	**Uranium mining does not compromise the water quality in the lower Khan and Swakop rivers.**			
Indicator 4.1.2.1.	**The water quality does not deteriorate compared to the historical baseline.**			
Data Source	**DWAF**			
Status:			**MET**	

Some commercial farmers along the rivers and on the lower Swakop smallholdings use groundwater for livestock watering and crop irrigation. To assess whether this indicator has been met DWAF collected water samples from 14 SEMP monitoring boreholes (Figure 16) in June 2017. Some boreholes could not be sampled for various reasons, i.e. MH1 at Valencia was not accessible, KEM3 at Rössing mine was dry and WW201569 in the farming area hard to find. Site SW1 shown on the map south of Husab Mine is now known as WW200898 and GAHD020 near Goanikontes is identified as WW200850 in Table 16.

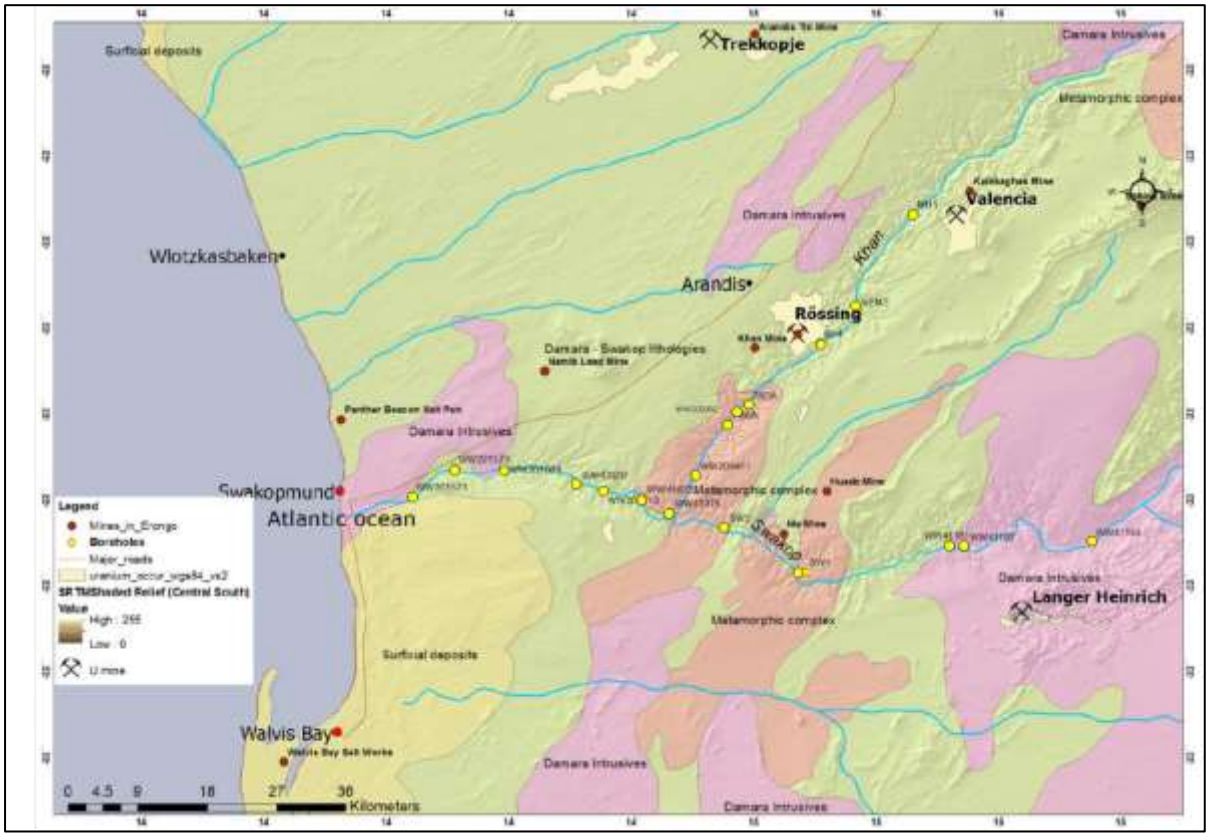

Figure 16: SEMP Monitoring Boreholes

Table 16 shows the relevant parameters from the analyses carried out at the NamWater laboratory compared to the Namibian water quality standard for livestock watering. The figures are in milligrams per litre (mg/L); highlighted in red are concentrations exceeding the limits for stock watering.

Table 16: Khan and Swakop River Water Quality 2017

Determinant (mg/L)	Livestock limits	Khan BH4	Khan 200411	Khan 202082	Swakop 41184	Swakop 41182	Swakop 41181	Swakop SW2
Total dissolved solids (calculated)	6000	5641	5132	6131	2841	7203	7879	4040
Chloride as Cl^-	3000	2440	2160	2690	890	3080	2930	1580
Fluoride as F^-	2.0-6.0	1.0	1.1	1.3	0.2	0.2	0.1	0.5
Sulphate as SO_4^{2-}	1000	640	660	825	530	860	910	560
Nitrate as N	100	6.4	11.9	9.0	0.9	0.5	0.9	<0.05
Sodium as Na	2000	941	957	61	450	1420	1450	710
Magnesium as Mg	500	242	172	232	93	186	196	93
Calcium as Ca	1000	460	400	566	280	680	710	420
Iron as Fe	NA	2.7	4.1	0.04	0.06	0.01	0.84	0.16
Manganese as Mn	NA	0.27	0.1	<0.01	0.53	1.8	1.5	1.4
Cadmium as Cd	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead as Pb	NA	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic as As	NA	0.01	0.01	0.01	0.04	0.02	0.03	0.02
Uranium as U	NA	0.07	0.11	0.19	<0.05	0.06	<0.05	0.09

Determinant (mg/L)	Livestock limits	Swakop 200898	Swakop 41075	Swakop 41072	Swakop 200413	Swakop 200850	Swakop 201570	Swakop 201571
Total dissolved solids (calculated)	6000	3605	4429	6995	8616	10244	10352	17688
Chloride as Cl^-	3000	1460	1800	2875	3325	4120	4200	8100
Fluoride as F^-	2.0-6.0	0.1	0.6	0.4	0.4	0.3	0.4	0.1
Sulphate as SO_4^{2-}	1000	380	480	1160	950	1100	750	1000
Nitrate as N	100	10.5	6.0	2.5	8.1	6.7	15.5	1.5
Sodium as Na	2000	589	790	1417	1680	1950	1750	3500
Magnesium as Mg	500	97	115	196	237	314	254	447
Calcium as Ca	1000	360	385	600	680	890	780	1240
Iron as Fe	NA	0.04	2.5	0.06	11.7	0.04	0.64	2.3
Manganese as Mn	NA	<0.01	0.07	1.2	0.58	0.71	0.04	0.48
Cadmium as Cd	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead as Pb	NA	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic as As	NA	0.02	0.02	0.01	<0.01	0.03	0.03	0.03
Uranium as U	NA	<0.05	0.05	0.12	0.10	0.12	0.06	<0.05

The standard does not set limits for the metals that were analysed and results for the Swakop and Khan rivers should not be evaluated against the drinking water standard, because the groundwater is naturally brackish to saline. Just for comparison, the currently valid upper limits for drinking water according to the Water Act (Act 54 of 1956) and its regulations are arsenic 0.3 mg/L, cadmium 0.02 mg/L, iron 1 mg/L, lead 0.1 mg/L, manganese 1 mg/L and uranium 4 mg/L.

The analyses show that the salinity generally increases towards the coast, but pockets of fresher water from recent flood events can be found all along the lower Swakop, except for the area of the smallholdings. Water quality studies from the time before the start of uranium mining, especially a

detailed survey of the entire Swakop River in the 1960s, show that the excess salinity has natural causes such as evaporation and transpiration from wetlands, upwelling at compartment boundaries, as well as the inflow of saline groundwater from tributaries and bedrock. [4445]

Khan River groundwater slightly exceeds the limit for TDS at one site, but is otherwise fine for stock watering. Swakop River water is of suitable quality at four sites in the Langer Heinrich, Ida Dome and Etango compartments, whereas groundwater from the Husabberg and Etango compartments, as well as the farming area is too saline for stock watering. There is no Namibian water quality standard for crop irrigation water, though the salinity index and sodium adsorption ratio can be used to assess the suitability of a water source for this purpose. Farmers along the Swakop and Khan rivers know that only certain plants, such as olive trees, can tolerate brackish groundwater, and use fresh water from the NamWater pipeline for other crops.

Uranium concentrations up to 0.19 mg/L were measured in the Khan River downstream of Rössing mine, while the maximum values in the Swakop River reached 0.12 mg/L between Palmenhorst and Goanikontes. Specialist studies carried out as part of the 2010 SEA concluded that uranium in Khan and Swakop groundwater originated from weathering of uranium-bearing rock types that occur in the catchment areas.[46]

Motivation of status: The indicator was **MET** because monitoring results confirmed that the water quality in the Swakop and Khan rivers was within the range of historical variations.

Desired Outcome 4.2.	**The natural environment, urban and rural communities have access to adequate water.**			
Target 4.2.1.	**Uranium mining does not compromise surface and groundwater availability.**			
Indicator 4.2.1.1.	**Groundwater abstraction from NamWater's Central Namib water scheme does not exceed the aquifers' sustainable yield.**			
Data Source	**DWAF, NamWater**			
Status:			**MET**	

Following good recharge of the Kuiseb River aquifers in 2011 NamWater increased the pumping rate from 4.8 Mm^3/a to the permitted quota of 7 Mm^3/a. NamWater's graph for the status of the Swartbank and Rooibank wellfields in the Kuiseb River (Figure 17 on the next page) shows the monthly abstraction rates up to the first quarter of 2018, while the water level graph ends in July 2016. The borehole levels required to calculate the average water level have not been measured in 2017.

[44] NIWR (1966): Verslag oor Opname van die Swakoprivier, Suidwes Afrika, met Spesiale Verwysing na die Chemiese Kwaliteit en die Faktore wat die beinvloed. Contract Report C WAT 10

[45] National Institute for Water Research, CSIR, Pretoria, and DWAF (1977): Gehalte- en Potensiaalopname van Grondwater in die Swakoprivier vanaf Horebis-Noord tot by Nabas. Internal Report No. WW 30/95/3, Hydrology Division, Department of Water Affairs, Windhoek

[46] MME (2010): Strategic Environmental Assessment for the Central Namib Uranium Rush. Ministry of Mines and Energy, Republic of Namibia, Windhoek

Since abstraction was mostly below the sustainable yield of 600,000 m^3 per month, the water level decline should have flattened out as indicated by the last few readings in 2016. [47]

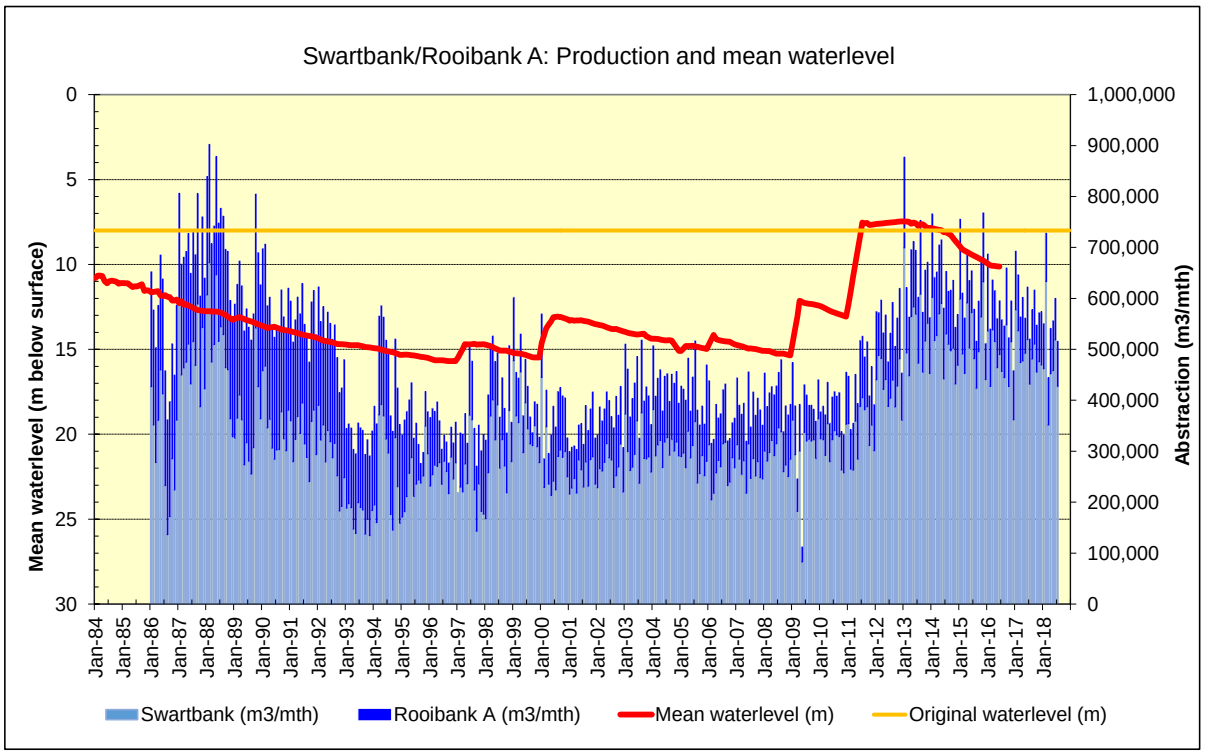

Figure 17: Abstraction and Average Water Level of the Kuiseb Aquifer

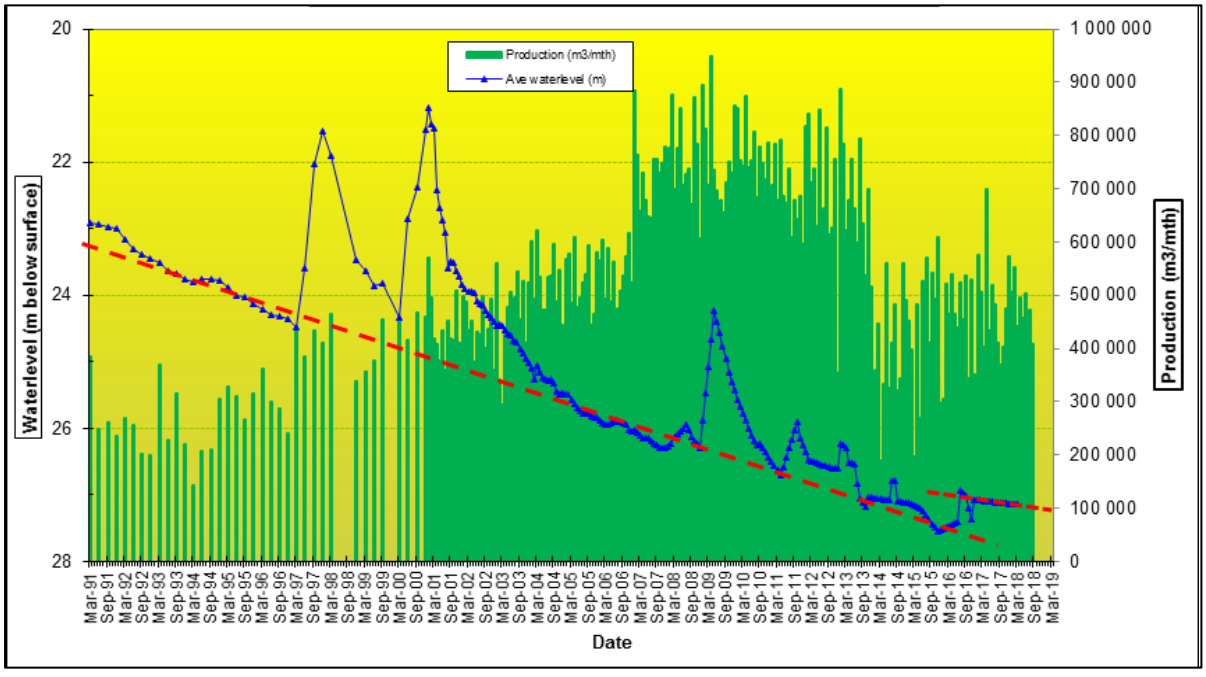

Figure 18: Abstraction and Average Water Level of the Omdel Aquifer

[47] Pers. comm. NamWater, 2018

Since the Omdel abstraction permit for 9 Mm^3/a expired in 2013 studies were conducted to determine the current sustainable yield. NamWater initially reduced the Omdel abstraction to 6 Mm^3/a until MAWF issued a permit for 3 Mm^3/a. NamWater appealed against this reduction and updated the groundwater model in 2017. This resulted in a recommended abstraction of 4.5 Mm^3/a, to be reviewed every two years. NamWater applied to MAWF and was awaiting the revised permit.[48] The average water level of the aquifer recovered in 2015-2016 after the abstraction was reduced (Figure 18). Occasional water level peaks in this graph show are due to recharge from the Omdel dam.

Motivation of status: Based on the available information it appears that the groundwater abstraction from the Kuiseb and Omdel water schemes did not exceed the aquifers' sustainable yield as determined by DWAF. The indicator was **MET**.

Indicator 4.2.1.2.	**Borehole levels fluctuate within existing norms.**			
Data Source	**NUA/DWAF**			
Status:			**MET**	

The effect of groundwater abstraction on the stored water resources of the Khan and Swakop rivers is assessed by monitoring the water level fluctuations in boreholes that MAWF and mines drilled in these rivers. Groundwater levels in the SEMP monitoring boreholes along the Swakop and Khan Rivers were monitored in 2017 with the results shown in Table 17 compared to previous measurements. The water levels are shown in metres below top of borehole collar.

Table 17: SEMP Borehole Locations and Water Levels 2013-2017

WW no.	Latitude	Longitude	Location	WL 2013	WL 2014	WL 2016	WL 2017
KEM3	-22.4579	15.1202	Rössing	8.92	9.32	collapsed	
BH4	-22.4945	15.0750	Rössing	9.51	8.42	9.98	8.01
200411	-22.6496	14.9304	Rössing	17.80		19.18	19.38
202082	-22.5626	14.9965	Husab	11.79	11.86	12.14	12.05
41184	-22.7273	15.3924	Langer Heinrich	5.20	5.77	7.16	7.06
41182	-22.7316	15.2461	Langer Heinrich	2.94	2.70	3.67	3.86
41181	-22.7308	15.2272	Langer Heinrich	3.66	3.38	4.16	4.33
SW1	-22.7613	15.0584	Husab	2.42	3.01	collapsed	
200898			Husab	replaces SW1		4.20	5.02
SW2	-22.7316	15.0213	Husab	2.30	2.54	2.99	3.27
41075	-22.6928	14.9001	Bannerman	4.67	3.94	4.43	4.70
41072	-22.6766	14.8694	Bannerman	4.86	4.18	4.83	5.10
200413	-22.6679	14.8225	Bannerman	3.65	2.79	3.43	3.70
200850	-22.6595	14.7925	Bannerman	3.99	3.01	3.49	3.73
201569	-22.6444	14.7092	Lower Skp Farms		3.10	6.13	5.34
201570			Lower Skp Farms			3.76	2.73
201571	-22.6739	14.5998	Lower Skp Farms		1.82	2.83	1.87

[48] Pers. comm. NamWater, 2018

Figure 19 shows the water levels at the SEMP boreholes, which are arranged from upstream on the right to downstream on the left. A moderate decline between 2013 and 2017 indicates the normal trend in the absence of recharge. An exception is the sudden drop from 3.10 to 6.13 m at WW201569 in the upper part of the farming area, which could point to substantial abstraction in 2015-16. A small flood in March 2017 raised the water levels in the farming area. The Khan River flowed in the Rössing area after rains in February and March 2017, leading to a recovery of the water levels at BH4 and WW202082, but not at WW200411 in the Khan Confluence compartment.

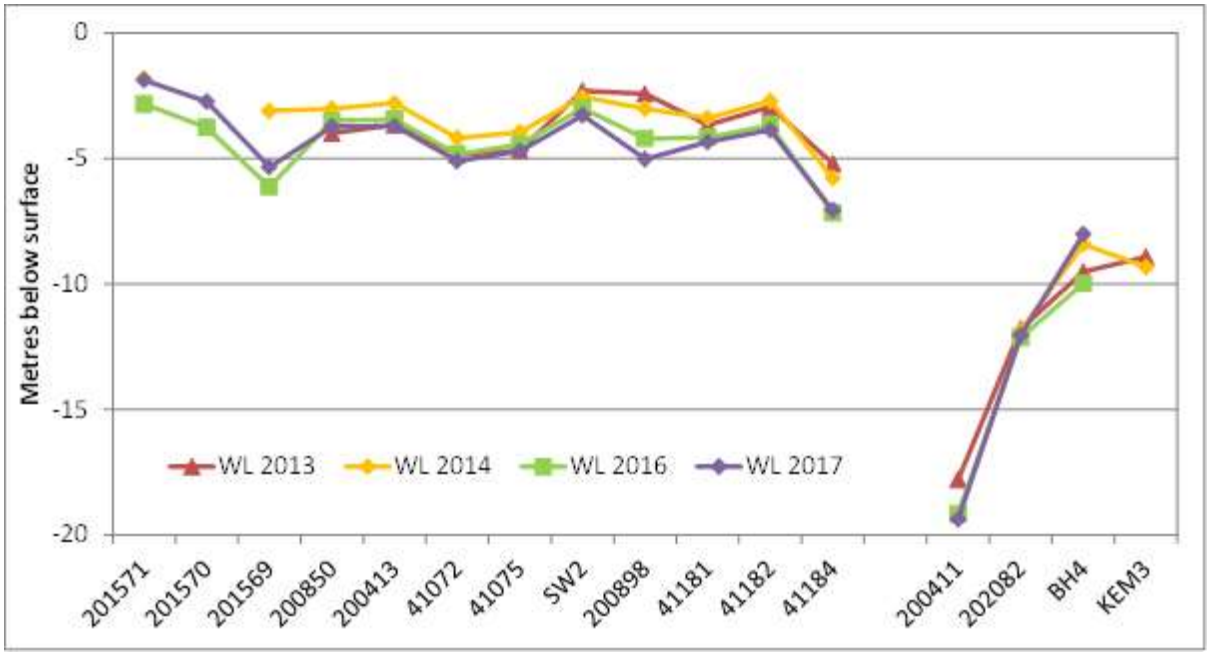

Figure 19: Water Levels Trends of SEMP Boreholes 2013-2017

Bannerman Mining Resources Namibia, Langer Heinrich Uranium, Rössing Uranium and Swakop Uranium monitor water levels in the Khan and Swakop rivers. They have provided their data to complement the SEMP water levels and broaden the data set on which the definition of fluctuation "within existing norms" is based.

Generally water levels in the rivers rise when the aquifers are recharged during floods and fall as a result of evapotranspiration (a combination of evaporation from wet sand and transpiration of riverine vegetation) and drawdown due to pumping. It is important to note that water levels always drop except during and just after runoff. The natural decline results in gently sloping graphs like the upper four lines in Figure 20 on the next page, while a slightly steeper decline occurs where abstraction is taking place, e.g. the lower three lines in Figure 20.

Langer Heinrich Mine measures monthly water level measurements at 18 boreholes in the Swakop River to monitor the effect of abstraction on the aquifer. The mine, which is now under care and maintenance, used to operate one production borehole to abstract saline groundwater for industrial purposes. Figure 20 shows the water level trends over the last five years at seven representative sites. The aquifer received some recharge from flood water in early 2017 as indicated by rising water levels at four boreholes. The water levels at the other three boreholes did not reflect this flood event, but continued following the normal declining trend caused by evapotranspiration losses and sustainable abstraction.

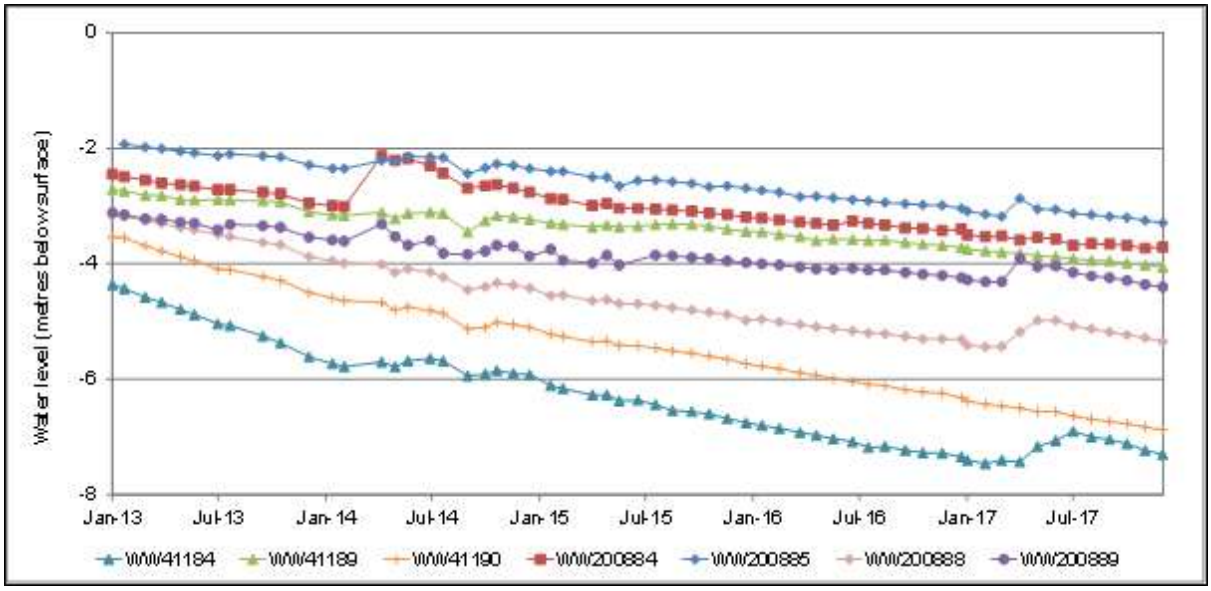

Figure 20: Water Level Trends in the Swakop River at Langer Heinrich Mine

Swakop Uranium monitors the stretch of the Swakop River downstream of Langer Heinrich to the vicinity of the Khan River confluence. This area received some recharge from a small flood event in March 2017 that only affected two boreholes, SW2 and SW4 (**Error! Reference source not found.**).

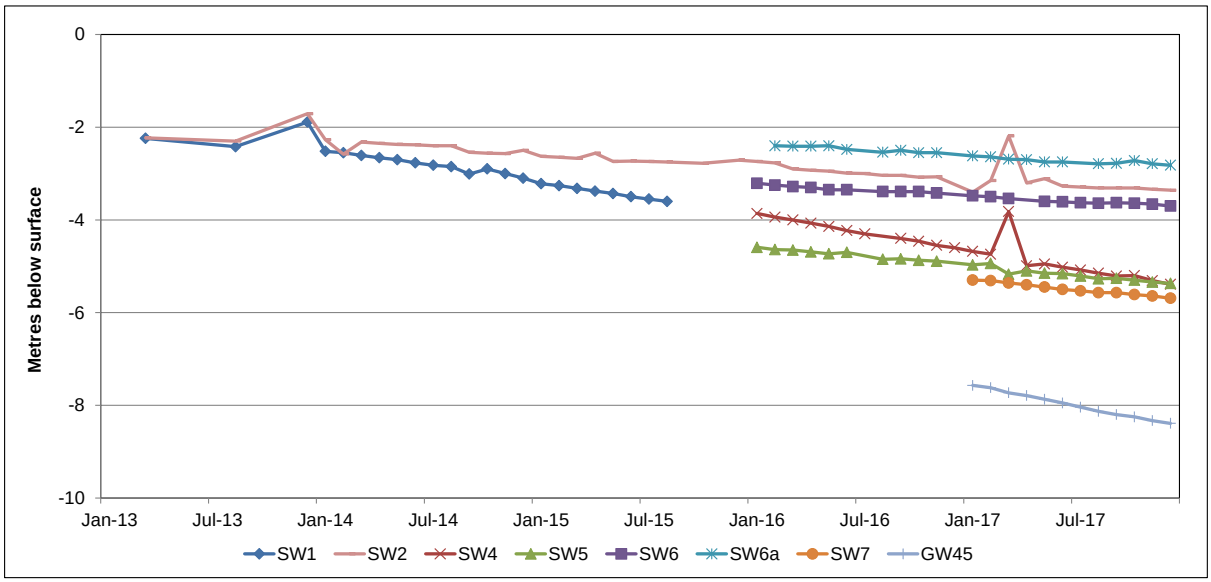

Figure 21: Water Level Trends in the Swakop River in the Swakop Uranium Area

The water levels in the Bannerman Mining Resources Namibia boreholes between Palmenhorst and Goanikontes have been dropping steadily since the last recharge event at the end of 2013 (Figure 22 on the next page).

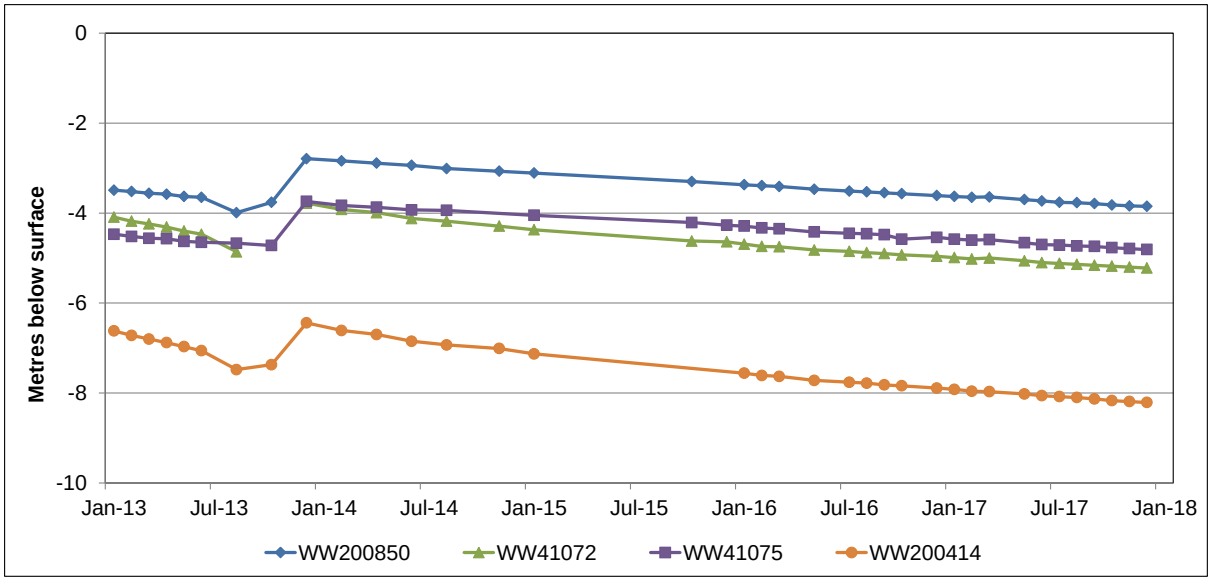

Figure 22: Water Level Trends in the Swakop River in the Bannerman Area

Most of the boreholes in the Khan River monitored by Rössing Uranium received some recharge in 2017, as indicated by a slight rise in the water levels displayed in Figure 23. While the water table in the Swakop River is situated 2-7 m below surface, it is generally deeper at 6-17 m below surface in the Khan River.

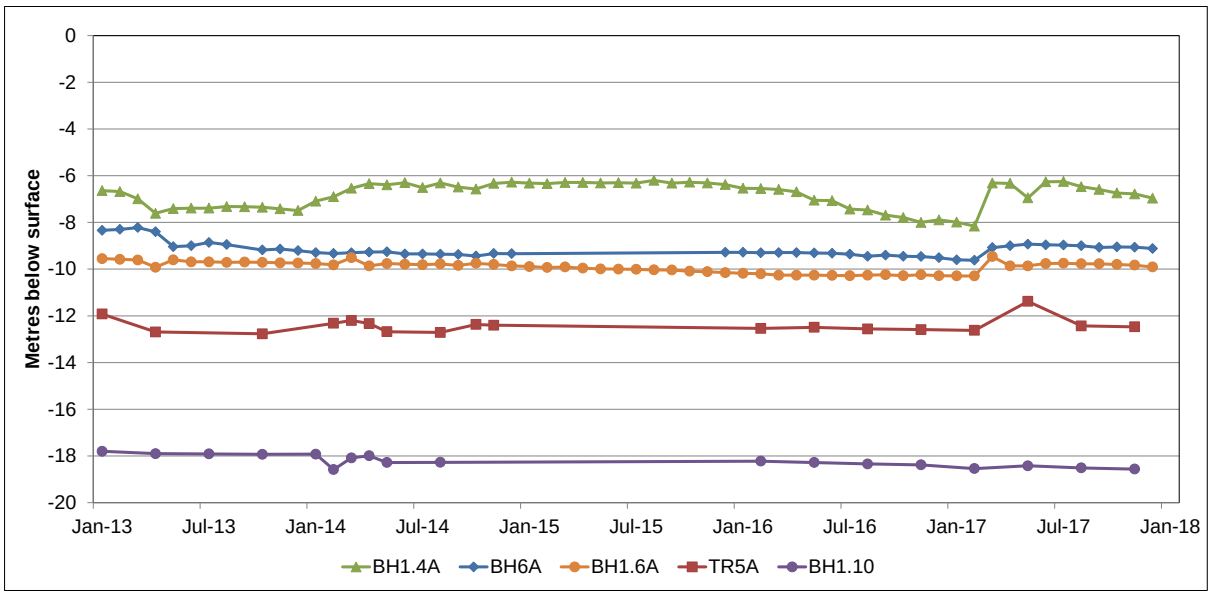

Figure 23: Water Level Trends in the Khan River at Rössing Uranium

Motivation of status: The monitoring data indicate that the range of water level fluctuations observed in the Swakop and Khan rivers were in line with the normal trend that is caused by evaporation of water from wet sand and uptake by trees and shrubs growing in the river beds. This indicates that groundwater abstraction by mines and other consumers did not negatively affect the water resources. The indicator was **MET**.

Indicator 4.2.1.3.	Aquifer water will be made available to domestic users at approved NamWater rates.			
Data Source	NamWater			
Status:			MET	

Bulk water users supplied from NamWater's Central Namib scheme paid water rates approved by Government. The tariffs for all consumers supplied from the Central Namib scheme were standardised to N$10.60 per cubic metre for groundwater and N$14.81 for blended water, a mix of groundwater and desalinated seawater (Table 18).[49] This resulted in increases in the groundwater tariffs by 10-20% compared to 2016 for most consumers, while the rates for Omdel-Swakopmund and Arandis dropped by 1% and 5% respectively. NamWater has however not implemented the tariff for blended water in 2017 as discussions with the affected town councils were still in progress.

The municipalities determine their own tariffs for domestic and industrial users, which are generally higher than the NamWater rates. For instance, the Swakopmund Municipality has gazetted rates of N$14.80/$m^3$ for 9-30 m^3, N$20.90/$m^3$ for 31-60 m^3 and N$32.20/$m^3$ for over 60 m^3 in 2018.[50] The intention of these staggered tariffs is to encourage water saving.

Table 18: NamWater Tariff Increases for 2017 (Government Gazette No. 6318)

Scheme Description	Tariff 2016	% Increase	Tariff 2017
Henties Bay (groundwater)	9.30	14%	10.60
Henties Bay (blended water)			14.81
Rooibank Mile 7 Walvis Bay (groundwater)	9.10	16%	10.60
Rooibank Mile 7 Walvis Bay (blended water)			14.81
Swakopmund reservoir (groundwater)	9.65	10%	10.60
Swakopmund reservoir (blended water)			14.81
Omdel-Swakopmund (groundwater)	10.65	-1%	10.60
Omdel-Swakopmund (blended water)			14.81
Swartbank Schwarzekuppe (groundwater)	8.85	20%	10.60
Swartbank Schwarzekuppe (blended water)			14.81
Arandis Town (groundwater)	11.10	-5%	10.60
Arandis Town (blended water)			14.81

Tariffs for mines are not gazetted because they are subject to confidential contracts between NamWater and the individual companies. Mining companies reported to NUA that they paid the full price for desalinated water.

[49] Government Gazette No. 6318, 2017
[50] Government Gazette No. 6638, 2018

Motivation of status: The tariffs charged in 2017 were based on the cost of aquifer water and did not include additional increases to recover the higher cost of desalinated water from domestic consumers. The indicator was **MET**.

Indicator 4.2.1.4.	**NamWater disaster management plans are in place and implemented in case of flood damage to supply schemes.**			
Data Source	**NamWater**			
Status:			**MET**	

The uninterrupted water supply to urban and industrial users, even in case of flood damage to one of the wellfields, is NamWater's responsibility. NamWater reported the following status of the disaster management plan in 2017:[51]

- An early flood warning system is in place at Gobabeb weir, as well as some monitoring upstream by DWAF.
- The Kuiseb power lines and pipelines have been replaced or reinforced to withstand flood damage.
- Resources such as manpower and spare parts are provided to repair flood damage to infrastructure as soon as possible.
- A project to upgrade the pipeline between Swakopmund and Walvis Bay, so that Omdel water can be pumped to Walvis Bay in case of damage to the Kuiseb system is in progress; completion depends on the availability of funds.

Motivation of status: Because most of the required components of the flood emergency plan were in place the indicator was **MET.**

Desired Outcome 4.3.	**Water for industrial purposes is available and reliable.**			
Target 4.3.1.	**Additional water resources (notably desalinated water) are developed to meet industrial demand.**			
Indicator 4.3.1.1.	**Industrial investors are not lost because of water unavailability.**			
Data Source	**DWAF**			
Status:			**MET**	

NamWater secured the water supply for industrial development in 2017 by augmenting the groundwater resources with desalinated seawater as required by Target 4.3.1. The authors of the SEA report probably saw desalination as a solution to the water supply problem without realising its economic impact. The uranium mining industry was to some extent affected by the cost of desalinated water, but other developments went ahead, e.g. North River's Namib Lead Mine. Though reliable

[51] Pers. comm. NamWater, 2018

information about lost investment opportunities was not available, it is obvious that international investors will consider all input costs and rather establish water-intensive industries in the northern areas of Namibia or in countries with cheap and plentiful water. The SEMP probably did not intend to promote the establishment of such industries in the Erongo Region.

Motivation of status: The desalination plant ensured that more than enough water was available for appropriate industrial development. The indicator was **MET**.

Indicator 4.3.1.2.	**Desalinated water meets mine demand**			
Data Source	**DWAF/NUA**			
Status:		**IN PROGRESS**		

In 2017, NamWater supplied 10.95 Mm^3 of desalinated water to Langer Heinrich, Rössing Uranium and Swakop Uranium (Figure 24).[52] A few scheduled and unscheduled plant shutdowns however occasionally disrupted the constant water supply. It was reported that the prolonged outages due to sulphur outbreaks and algal blooms in February 2017 caused production losses at the mines.[53]

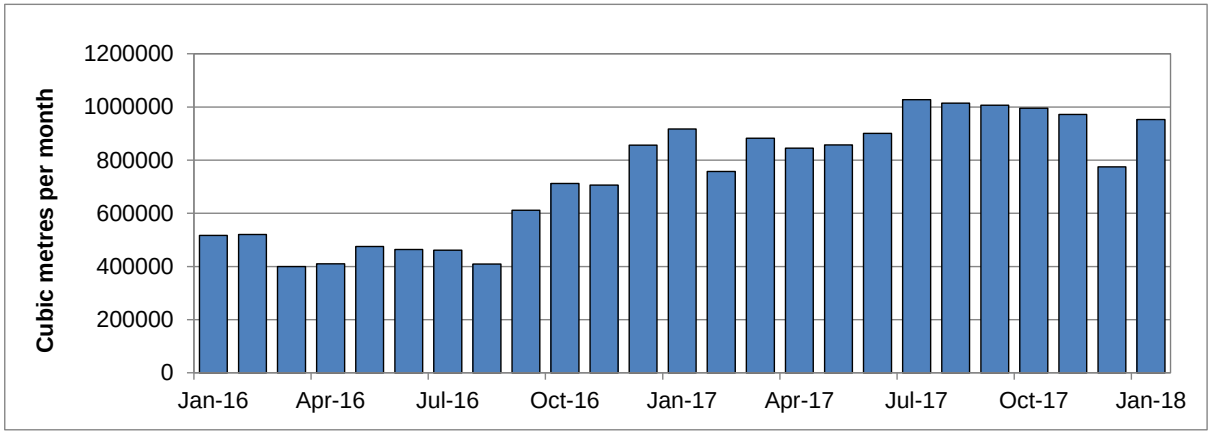

Figure 24: Volumes of Desalinated Water Supplied in 2016-2017

The water supply contract between NamWater and the Erongo desalination plant makes provision for the plant to be stopped during sulphur outbreaks because the high sea water turbidity and hydrogen sulphide concentration during these outbreaks would otherwise lead to fouling of the reverse osmosis membranes. NamWater could possibly have made up the shortfall by temporarily increasing the abstraction from the Omdel and Kuiseb wellfields, provided that enough pumping capacity was installed.

Motivation of status: The desalination plant was able to meet its contractual obligations towards the mines' demand in 2017. Options to modify the plant so that production can continue during sulphur outbreaks are under investigation. The indicator was thus **IN PROGRESS**.

[52] Data and graph provided by AREVA Resources Namibia
[53] Pers. comm. NamWater, 2018

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Summary of performance: EQO 4

Total no. indicators assessed: 8

	NOT MET	IN PROGRESS	MET	EXCEEDED
Number of indicators in class	0	1	7	0
Percent of indicators in class	0%	12.5%	87.5%	0%

Overall performance: Seven of the eight indicators in the Water EQO were **MET** (87.5%) in 2017, while one indicator related to the continuous availability of desalinated water during sulphur outbreaks was **IN PROGRESS** (12.5%). Contrary to fears expressed during the SEA process uranium mining did not compromise the water quality or lower the water table in the rivers. The water tariff for domestic users did not yet increase to the level required to cover the cost of desalinated water.

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EQO 5. Air Quality

Aims of this EQO: Workers and the public do not suffer significant increased health risks as a result of exposure to dust emission from the uranium mines.

The objective of the Air Quality EQO is the assessment of the additional contribution of the mines to the background dust concentration in the region, especially at the major towns. Dust emissions may occur during each stage of the mining cycle, in particular due to exploration drilling, mine construction and operational activities. The principal dust sources at mines include blasting, loading, hauling and crushing, wind erosion of exposed surfaces such as tailings, stockpiles, waste dumps and haul roads, and to a lesser extent fine particulates from the combustion of diesel fuel.

The SEMP Office is developing an overarching Air Quality Management Plan (AQMP) for the uranium and other industries in the Erongo Region. The aim is to establish mitigation measures that can be implemented by the various role players in a coordinated manner. At the core of the AQMP is an advanced air quality study commissioned in October 2016 and to be completed in February 2019. Five monitoring stations were established to measure fine dust and radon together with meteorological parameters. The objective is to determine current air quality in the region and report on public exposure from dust.

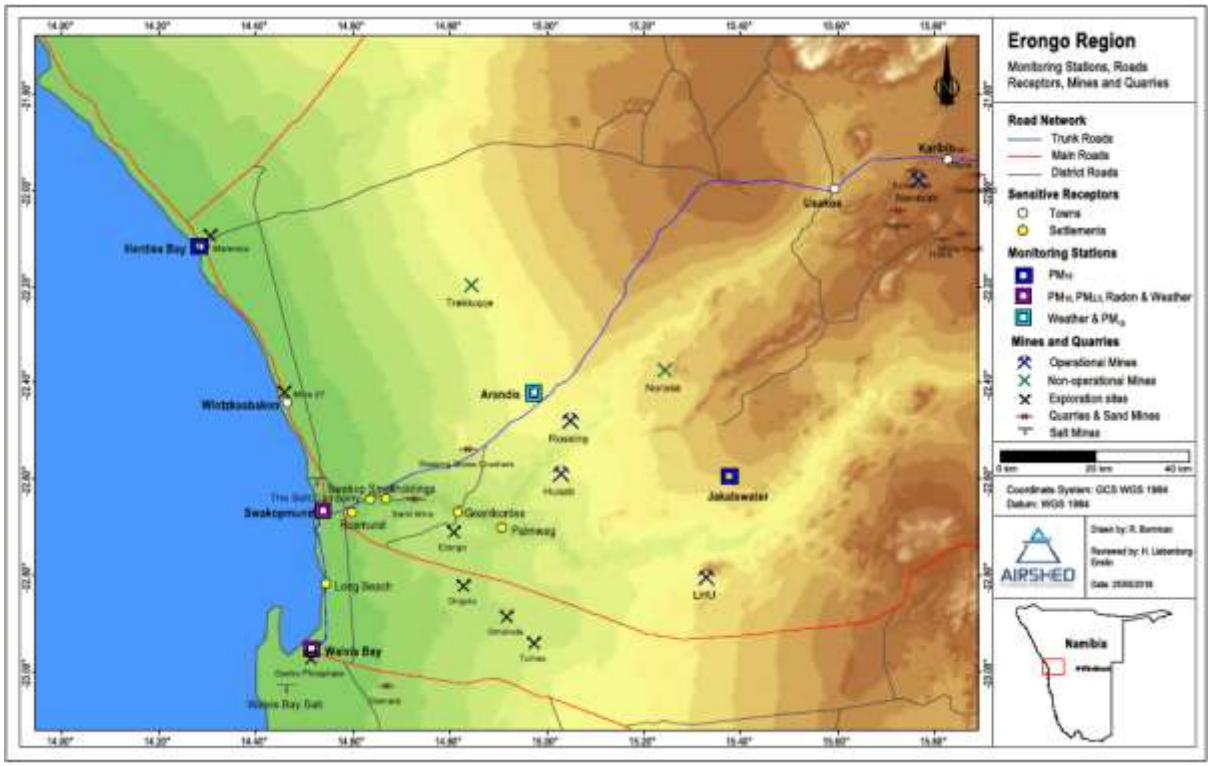

Figure 25: Location of Monitoring Stations (Map by Airshed)

The monitoring stations at Swakopmund, Walvis Bay, Henties Bay and Jakkalswater measure the PM_{10} dust concentration, ambient temperature, barometric pressure, wind speed, relative humidity, and wind direction. The stations at Swakopmund and Walvis Bay are also equipped with $PM_{2.5}$ moni-

tors to establish whether there is air pollution from the combustion of fuel or waste. Radon monitors have been placed at Arandis, Swakopmund and Walvis Bay (Figure 25).[54]

In the Erongo Region dust is generated by various sources including natural exposed areas prone to wind erosion, public roads (paved, treated and unpaved, vehicle tailpipe), various mining operations (uranium, stone quarries and sand mining), harbour emissions (ships, loading and unloading activities, mobile equipment), small boilers and incinerators. Dust comes in various shapes and sizes. The finer fractions, referred to as PM_{10} and $PM_{2.5}$, are of interest due to the potential for human health impact. Inhalable dust is also known as PM_{10} dust because its particles are smaller than 10 micrometres, while $PM_{2.5}$ is respirable dust that enters deep into the lungs.

The purpose of monitoring is to ensure that ambient PM_{10} concentrations at public locations do not exceed the targets or limits set for the area. The preliminary limits set in the SEA report for the Erongo Region were based on the World Health Organisation (WHO) IT-3 guidelines for PM_{10} dust: 75 µg/m³ for the average over 24 hours and 30 µg/m³ for the annual average. The WHO IT-3 correlates with the South African limit that was based on environmental, social and economic conditions that are similar to Namibia. The WHO allows three days where the 24-hour guideline may be exceeded and South Africa allows four days per calendar year. One of the aims of the GSN's advanced air quality study is to review this recommendation and propose a realistic standard for the region.

Desired Outcome 5.1.	**Annual human exposures to particulate concentrations are acceptable (IFC Standard).**
Target 5.1.1.	**Ambient PM_{10} concentrations at public locations and mines should not exceed the required target/limit to be set for the Erongo Region for both annual and 24-hour averages. The target/limit should be based on international guidelines but should consider local environmental, social and economic conditions.**
Indicator 5.1.1.1.	**Ambient PM_{10} monitoring (µg/m³) is carried out at Swakopmund, Arandis and operating mines.**
Data Source	**SEMP Office/NUA**
Status:	**MET**

Ambient PM_{10} dust was monitored in 2017 as part of the advanced air quality study mentioned above.[55] PM_{10} daily concentrations were on average higher at Swakopmund and Walvis Bay (Figure 26) than at Henties Bay and the inland stations of Arandis and Jakkalswater (Figure 27). The daily PM_{10} limit of 75 µg/m³ should not be exceeded on more than four days per year, yet it was exceeded on 21 days at Swakopmund and 27 days at Walvis Bay. At Arandis, the limit was only exceeded on two days, with a single exceedance day at Jakkalswater and none at Henties Bay. The annual aver-

[54] Map from Liebenberg-Enslin, H et al (2018): Advanced Air Quality Management for the Strategic Environmental Management Plan for the Uranium and Other Industries in the Erongo region: Ambient Air Quality Monitoring Report for the Period 1 January to 31 December 2017 Report No.: 16MME01-2

[55] Liebenberg-Enslin, H et al (2018): Advanced Air Quality Management for the Strategic Environmental Management Plan for the Uranium and Other Industries in the Erongo region: Ambient Air Quality Monitoring Report for the Period 1 January to 31 December 2017. Report No.: 16MME01-2

age PM_{10} concentrations of 37 µg/m³ at Swakopmund and 41 µg/m³ at Walvis Bay exceeded the annual limit of 30 µg/m³, while the other stations were below the limit.

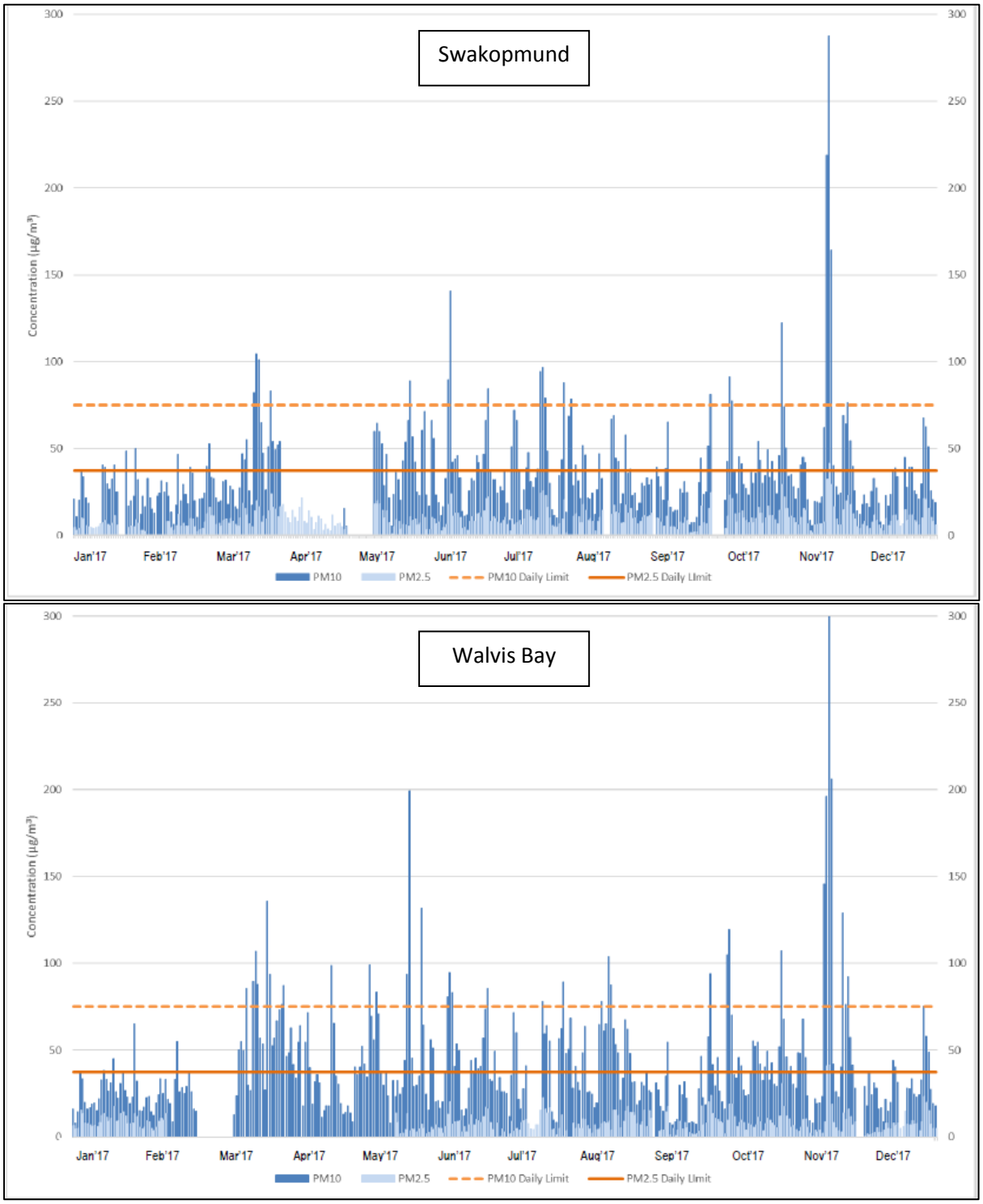

Figure 26: Ambient Dust Concentrations at Swakopmund and Walvis Bay in 2017

An evaluation of the wind directions and analysis the dust samples obtained during dusty conditions in towns indicated salt from sea spray and dust generated locally as the predominant sources. The peaks on 16-18 November 2017 were caused by strong winds from various directions during thunder storms. The $PM_{2.5}$ average daily concentrations at Swakopmund and Walvis Bay did not exceed the

daily limit of 37.5 µg/m³ and the annual average $PM_{2.5}$ concentrations remained well below the annual limit of 15 µg/m³ at both towns.

Figure 27: Ambient Dust Concentrations at Henties Bay, Arandis and Jakkalswater

As required by indicator 5.1.1., operating uranium mines monitor PM_{10} dust at the mine sites and at Arandis where both AREVA Resources Namibia and Rössing Uranium have monitoring stations. The annual average PM_{10} dust concentrations for 2013-2017 at the relevant receptor locations are summarised in Table 19.

Table 19: PM_{10} Dust Concentrations at Arandis Town and Uranium Mines

Locality	Average Annual PM_{10} Dust Concentration (µg/m³)				
Year	2017	2016	2015	2014	2013
Arandis, AREVA	9.8	9.0	9.8	9.1	10.4
Arandis, Rössing	18.8	15.9	8.6	11.4	15.8
Rössing CMC	23.9	23.3	21.7	No data	No data
LHU, entrance gate	40.7	34.3	45.4	42.1	44.3
Husab Mine	77.5	40.5	41.0	28.2	34.1

AREVA Resources Namibia recorded an average PM_{10} dust concentration of 9.8 µg/m³ in the centre of Arandis, while Rössing Uranium measured 18.8 µg/m³ on the eastern edge of the town (Figure 27). This was well below the WHO IT-3 limit of 30 µg/m³ for the annual mean. The average daily dust concentrations at the Arandis station were below the WHO IT-3 limit of 75 µg/m³ (Figure 28). Peak dust levels in the Erongo Region are normally associated with east wind events in winter, but the data for the last two years do not show evidence of severe sandstorms. The AREVA station's highest reading was 94 µg/m³ on 17 November 2017 when there were strong easterly winds during a rain storm. The station stopped working on 22 November 2017 and was replaced with another instrument on 20 January 2018.

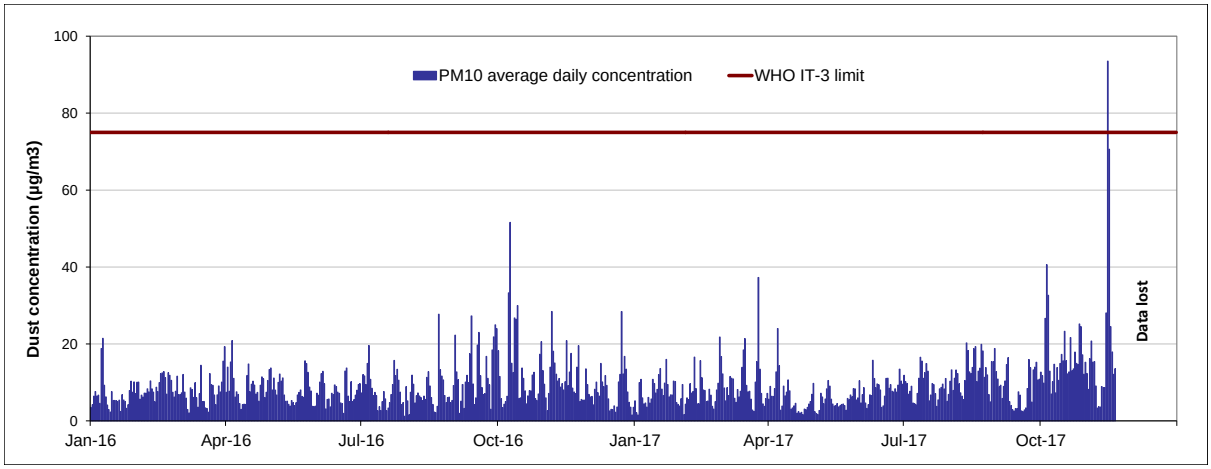

Figure 28: Average Daily PM_{10} Dust Concentration at Arandis (AREVA) in 2016-2017

Langer Heinrich Uranium uses high volume dust samplers fitted with PM_{10} heads to monitor dust levels in the environment. Samples are generally collected over a seven-day period. There are three samplers placed around the site with the one used for critical group assessments situated at the entrance gate to the mine. PM_{10} concentrations of 40.7 µg/m³ measured at this station were above the WHO-IT-3 interim guideline of 30 µg/m³ for annual mean concentrations (Figure 29). The relatively high dust levels were caused by traffic on the gravel road to the mine. Anemometer data for the entrance gate indicated that the wind was blowing from the mineralised section of the mine for less than 25% of the year.

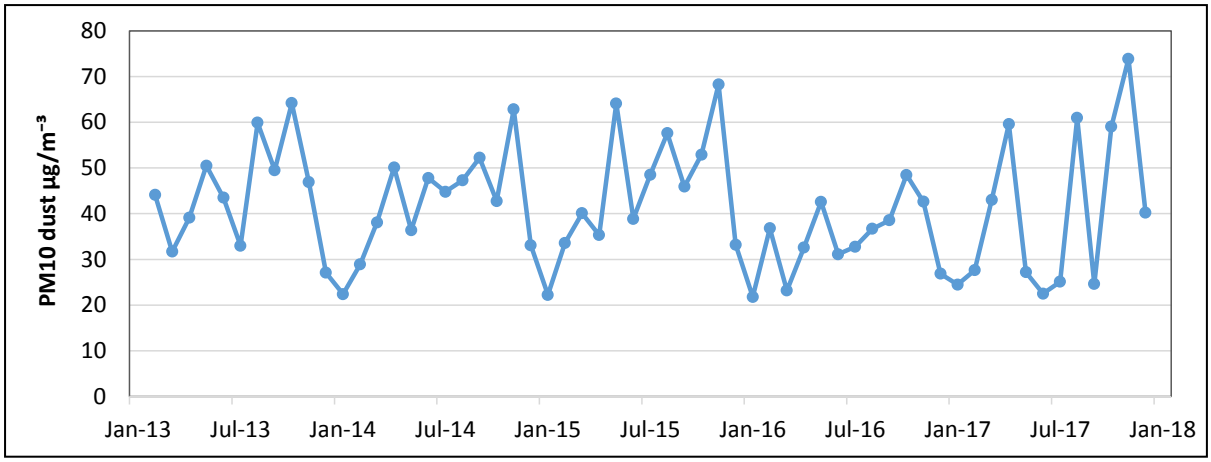

Figure 29: Average Monthly PM_{10} Dust Concentration at the LHU Entrance Gate in 2013-2017

Rössing Uranium operates PM_{10} stations at Arandis, the tailings storage facility, the Communications Management Centre and at the south-western mine boundary. The sampler at Arandis measures the PM_{10} dust concentration, wind speed and wind direction in intervals of 15 minutes. This allows the allocation of a dust concentration as mining-related (if the wind blows from the mine) or background (when the wind is blowing from any other direction). The main wind directions associated with high dust levels were south-west and east. The average annual PM_{10} dust concentration measured at Arandis was 18.8 µg/m^3, which is below the WHO annual guideline value. The daily limit of 75 µg/m^3 was exceeded on only two days (Figure 30).

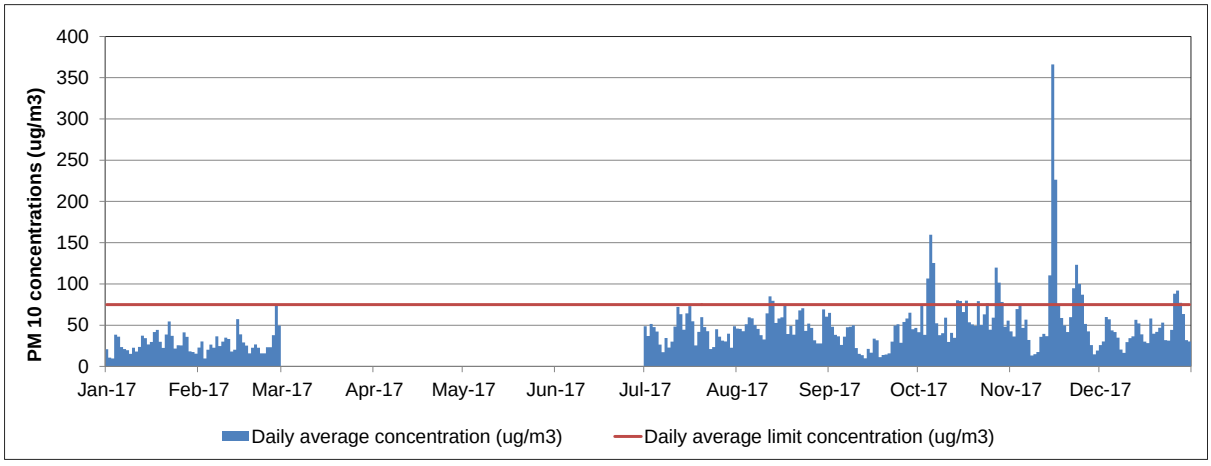

Figure 30: PM_{10} Dust Concentration at Rössing SW Boundary in 2017

The average PM_{10} concentration at the south-western mine boundary was 46 µg/m^3 (Figure 30). The peak dust concentration of 366 µg/m^3 was measured on 15 November 2017 during a few days of strong south-westerly winds. The daily limit of 75 µg/m^3 was exceeded on more than four days of the year. The wind direction during these days was predominantly south-west, which means that dust from the environment was blown towards the station on the mine boundary.

Swakop Uranium's Minivol monitor is located at the weather station close to the Husab mine waste rock dumps and north of Pit Zone 1. This is why it recorded a relatively high average of 77.5 µg/m³ in 2017 (Figure 31). The average exceeded the annual mean WHO IT-3 limit of 30 µg/m³, while the average daily dust limit of 75 µg/m³ was exceeded on 11 occasions with peak concentrations reaching up to 339 µg/m³. Exceedance of the WHO guideline highlights the need for mine workers to use respiratory protection in the designated areas; it does not mean that these localised emissions contribute to higher dust exposure of residents in neighbouring towns.

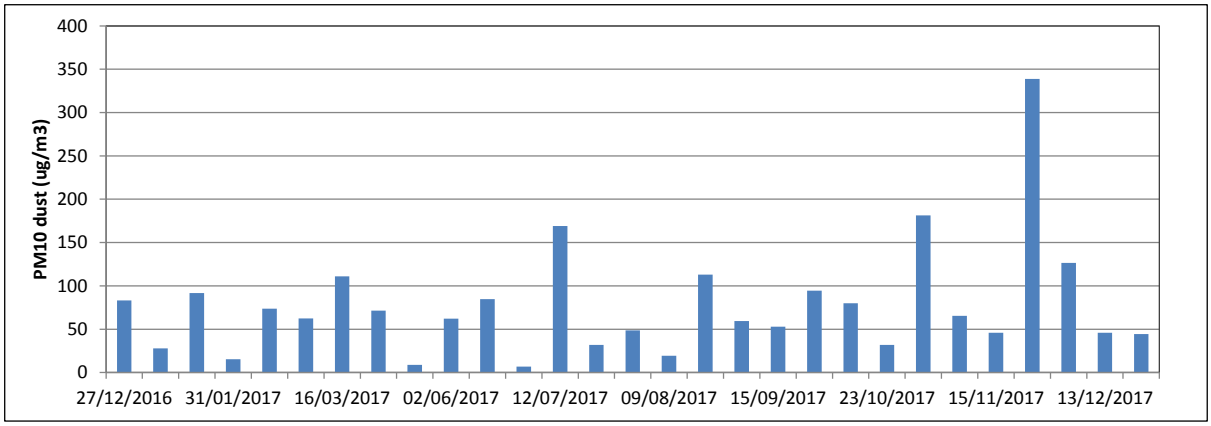

Figure 31: Average Daily PM10 Dust Concentration at Husab Mine in 2017

Motivation of status: The indicator was **MET** because PM_{10} dust was monitored at Swakopmund, Arandis and the operating mines, as well as additional sites. PM_{10} concentrations in residential areas were generally below the WHO IT-3 daily limit of 75 µg/m^3 with 6-7% exceedances at Swakopmund and Walvis Bay. Note that the WHO daily limit is just a preliminary guideline until more applicable standards are proposed in the advanced air quality study.

Desired Outcome 5.2.	**Nuisance dust resulting from uranium mining is within acceptable thresholds.**			
Target 5.2.1.	**Dust fallout levels at residences in towns should not exceed the recommended limit of 600 mg/m^2/day.**			
Indicator 5.2.1.1.	**Dust fallout levels in relevant towns are monitored continuously.**			
Data Source	**SEMP Office/NUA**			
Status:			**MET**	

Dust fallout or nuisance dust has particles larger than 10 micrometres and is usually monitored by means of dust buckets. Monitoring of the SEA dust fallout network ended in 2012 after an adequate baseline of regional dust fallout levels had been established. It was found during this survey that the highest dust concentrations outside of mining areas occurred in the vicinity of gravel roads and that none of the towns in the region were affected by dust fallout exceeding the 600 mg/m^2/day residential imit. To establish whether this was still the case in 2017 dust fallout was measured at three sites in Arandis. The results presented in the graphs for AREVA Resources Namibia (sites DM33 and DM34 in Figure 32) and Rössing Uranium (Figure 36) under indicator 5.2.2.1 showed dust levels below 150 mg/m^2/day.

Motivation of status: Target 5.2.1 specifies that dust fallout levels at residences in towns should not exceed the recommended limit of 600 mg/m^2/day. If this target is read together with the indicator that requires continuous dust fallout measurements to be carried out, it can be concluded that the intention has been **MET**.

Target 5.2.2.	**Mitigation measures to be implemented by mines at all major dust generating sources such as haul roads, materials transfer points and crushing operations. The best practical dust suppression methods should be implemented and monitored through dust fallout buckets at strategic locations.**
Indicator 5.2.2.1.	**Mines must implement a dust fallout network, measuring dust fall-out at main dust generating sources and mine license boundaries.**
Data Source	**SEMP Office/NUA/NRPA**
Status:	**MET**

All operating mines and mines under development applied mitigation measures and maintained dust fallout monitoring networks in 2017. The results are evaluated against the South African National Dust Control Regulations (SA NDCR) limit for residential areas of 600 mg/m^2/day and the limit for non-residential areas of 1200 mg/m^2/day. Both limits may be exceeded up to three times within any year, but not in successive months. This provision may however not be realistic for the Erongo Region where the east wind sometimes blows for several weeks during the winter season.

AREVA Resources Namibia monitored dust fallout every two months at 13 sites on Trekkopje mine, at Arandis and at the Erongo desalination plant. Dust levels were generally low with annual average values of 6-48 mg/m^2/day. The highest reading was 229 mg/m^2/day at DW27 in a low-traffic area in December 2017-January 2018 (Figure 32). Many monitoring sites showed slightly higher dust concentrations during the second half of the year, which may be caused by generally drier conditions and higher wind speeds during this time. The dust fallout at all sites was below the SA NDCR limit for residential areas of 600 mg/m^2/day.

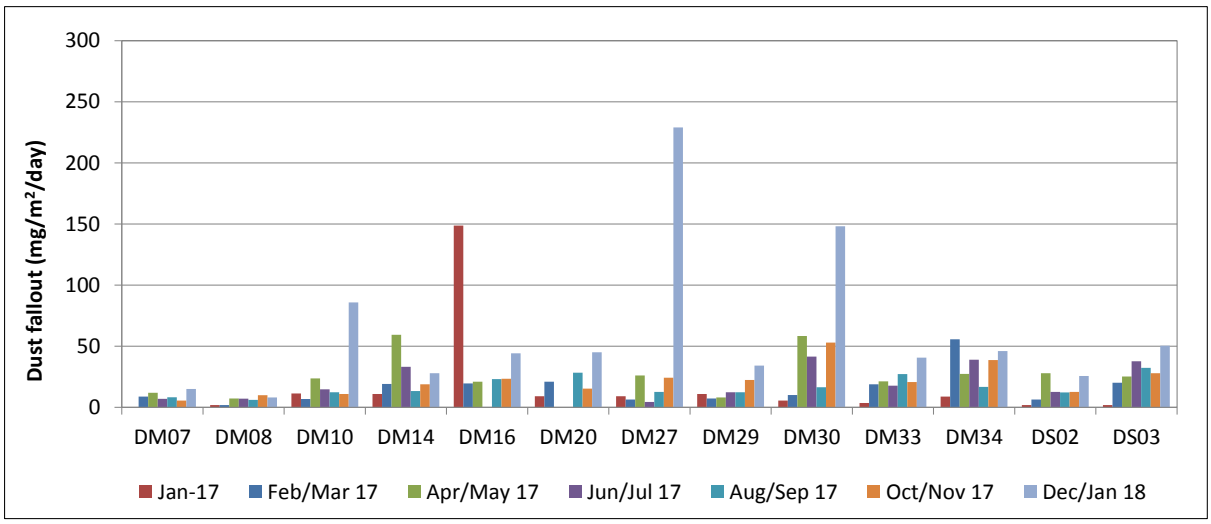

Figure 32: AREVA Resources Namibia Average Monthly Dust Fallout Concentrations

Annual average dust fallout rates at Bannerman Mining Resources' Etango project were very low (<100 mg/m²/day) at PPDF01, PPDF03, PPDF05 and PPDF06, with slightly higher dust levels (100-200 mg/m²/day) at PPDF02, PPDF04 and PPDF08 (Figure 33). PPDF07 and PPDF09 had the highest annual average rates of between 200 and 600 mg/m²/day.

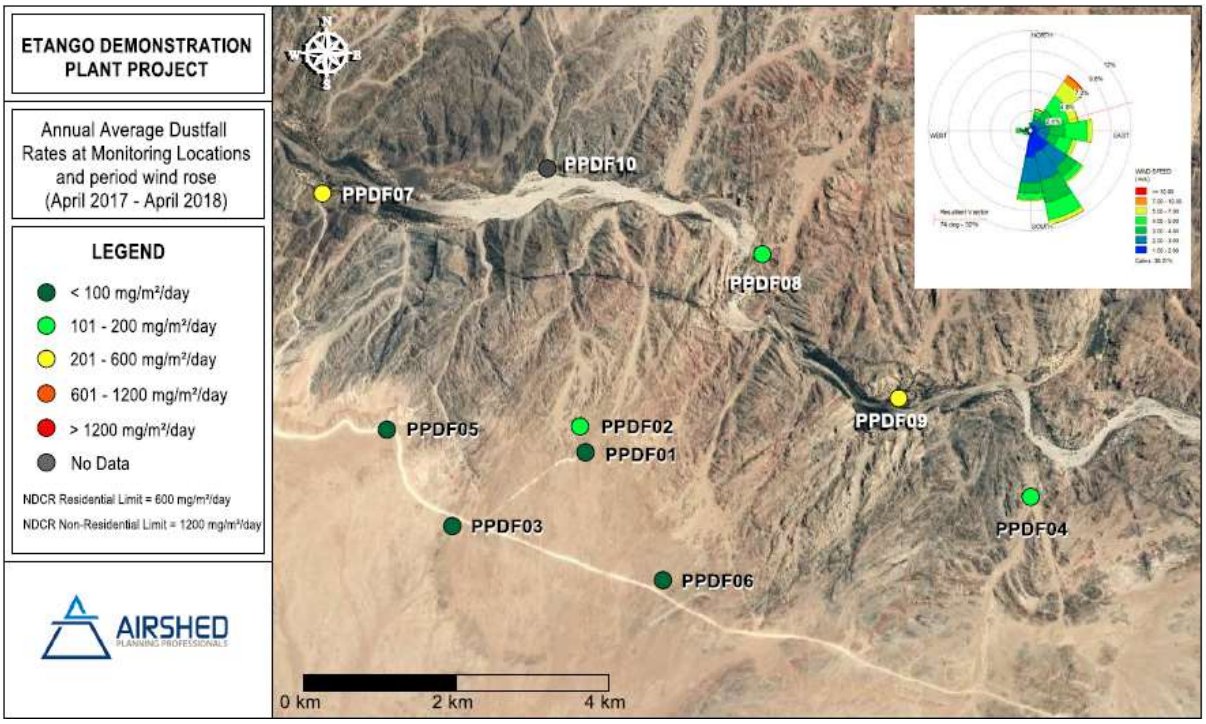

Figure 33: Bannerman Mining Resources Air Quality Monitoring Sites

The dust concentrations at farms Goanikontes (PPDF07) and Palmenhorst (PPDF09) exceeded the 600 mg/m^2/day SA NDCR residential limit and the 1200 mg/m²/day non-residential limit on several occasions in March to September 2017 (Figure 34). Bannerman Mining Resources did not carry out any unusual dust-generating activities at the heap leach facility in 2017,[56] which means that localised dust sources at or near the farms Goanikontes (PPDF07) and Palmenhorst (PPDF09) are the likely cause of the high dust levels.

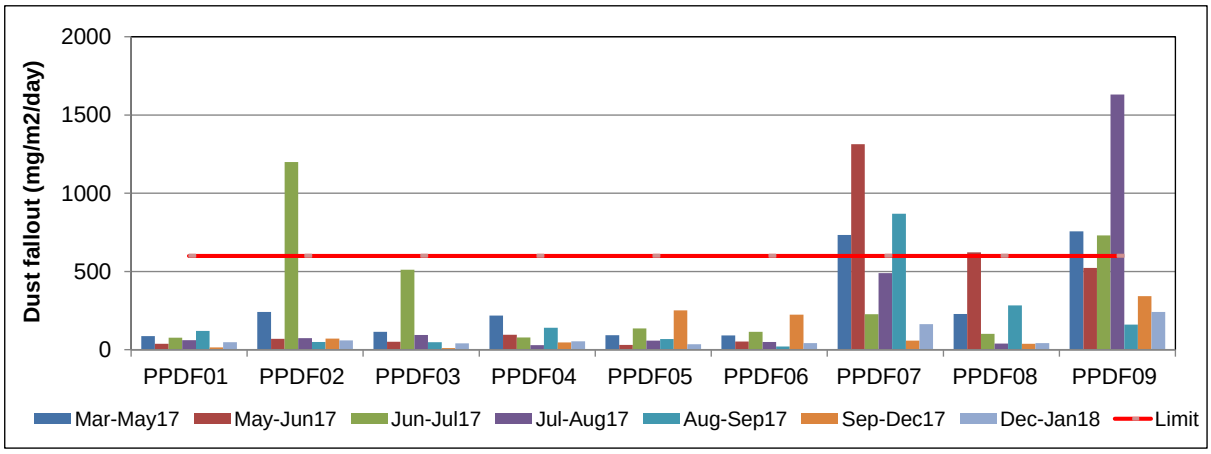

Figure 34: Bannerman Mining Resources Average Monthly Dust Fallout Concentrations

In 2017, Langer Heinrich Mine monitored dust fallout at 11 sites on and around the ML 140 area (Figure 35). Dust fallout rates at all locations recorded below the non-residential limit of 1200 mg/m^2/day. The Bloedkoppie site where tourists may camp and the Gecko campsite remained below the residential limit of 600 mg/m^2/day.

[56] Pers. comm. Bannerman Mining Resources Namibia, 2018

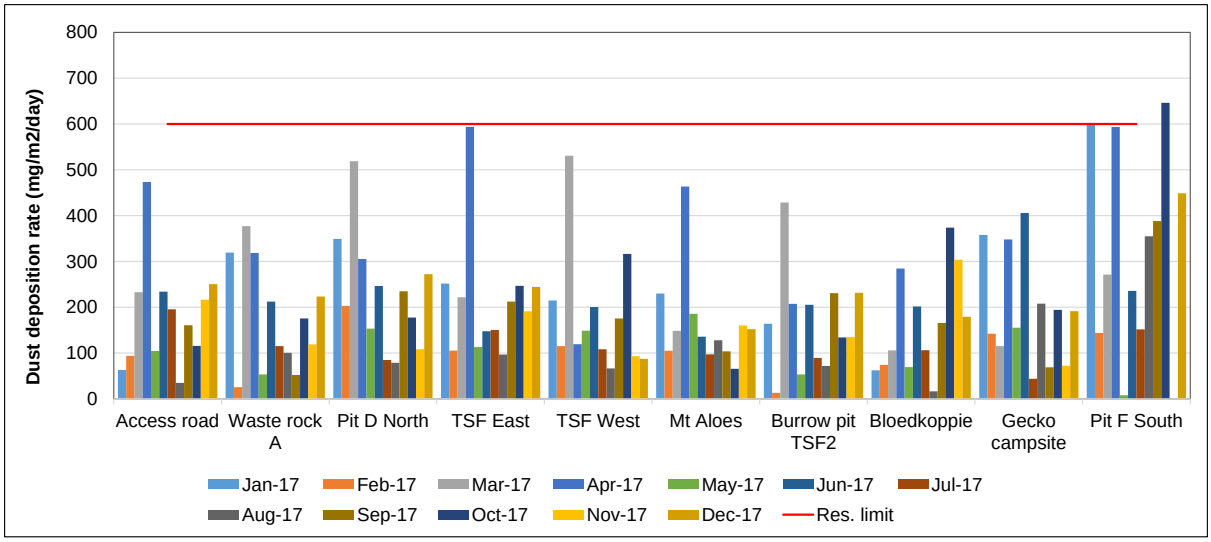

Figure 35: Langer Heinrich Mine Average Monthly Dust Fallout Concentrations

Rössing Uranium reported dust fallout results for Arandis and a site on the mine boundary south-west of the open pit (Figure 36). All the readings in 2017 were below 50 mg/m^2/day.

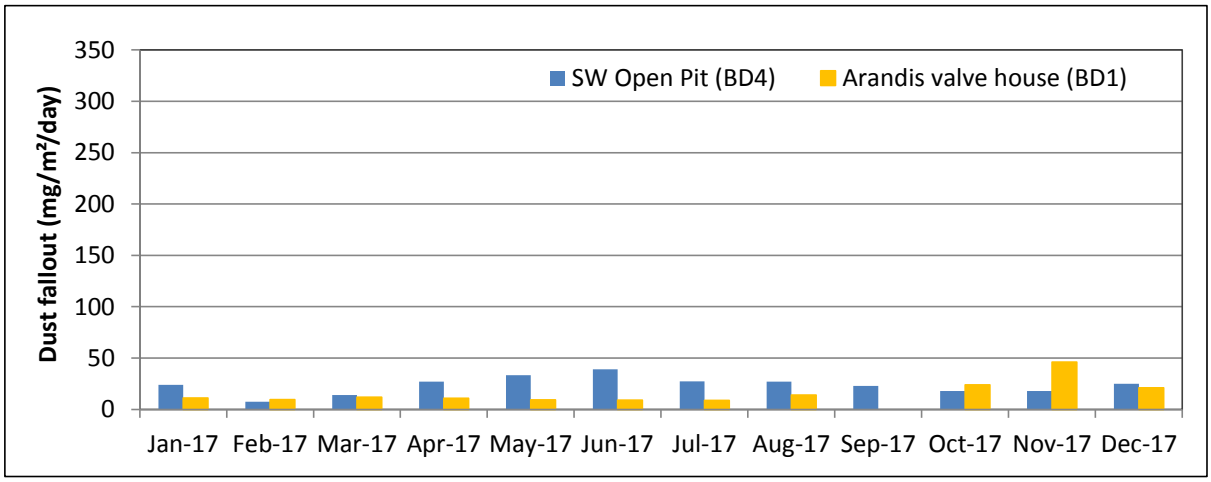

Figure 36: Rössing Uranium Average Monthly Dust Fallout Concentrations

Swakop Uranium monitored 33 dust fallout buckets on and around the Husab mine site in 2017, though only stations outside the operational area are shown in Figure 37. All the dust levels were below the SA NDCR limit for residential areas of 600 mg/m^2/day, varying between <50 mg/m^2/day to around 150 mg/m^2/day with a maximum of 157 mg/m^2/day at EXT 29 in Jul-Aug 2017.

Note the different vertical scales in the graphs for the mines on the plains (AREVA, Husab and Rössing) with a maximum of 350 mg/m^2/day compared to the mines in valleys where the vertical scale goes up to 800 mg/m^2/day at Langer Heinrich Mine and 2000 mg/m^2/day at Bannerman.

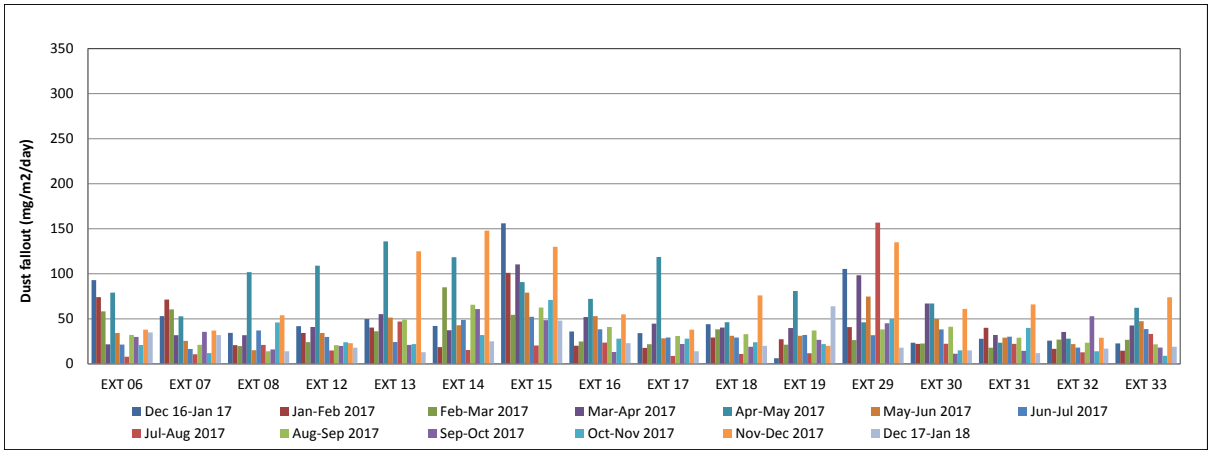

Figure 37: Swakop Uranium Average Monthly Dust Fallout Concentrations

Motivation of status: The indicator requires that mines implement dust fallout networks, measuring dust fallout at main dust generating sources and mine licence boundaries. The indicator was **MET** as demonstrated by the results presented above.

********** ********** ********** ********** **********

Summary of performance: EQO 5

Total no. indicators assessed: 3

	NOT MET	IN PROGRESS	MET	EXCEEDED
Number of indicators in class	0	0	3	0
Percent of indicators in class	0%	0%	100%	0%

Overall performance: All three indicators continued to be **MET** (100%) in 2017. The advanced air quality study provided additional data that will be used to define the long-awaited regional air quality standard. The regional monitoring system set up by the consultants will be handed over to GRN in 2019.

********** ********** ********** ********** **********

EQO 6. Health

Aims of this EQO: Adequate health services are available to all. Workers and the public do not suffer significant increased health risks from uranium mining.

Radiation has existed in the universe since the beginning of time. Light, heat, infrared and ultraviolet rays have bombarded the earth since it was formed. We have learned to harness the energy of many types of radiation, such as radio waves, microwaves and the radioactivity emitted by unstable atoms of elements such as uranium, and we have added human-made sources to those that occur in nature. Because radiation occurs naturally on earth, both people and the environment have adapted to certain levels of ionising radiation. We are exposed every day to background radiation from cosmic rays, building materials, food, the earth we walk on, and the air we breathe (Figure 38). The naturally occurring background radiation in the Erongo Region is approximately 1.8 millisieverts per annum (mSv/a).[57]

Uranium miners can be exposed to naturally-occurring radioactive materials (NORM) and more concentrated uranium. This occupational health hazard needs to be monitored and controlled. A dose is the amount of medically significant radiation a person receives. Although uranium itself is not very radioactive, the ore which is mined also contains decay products such as radon, and must be regarded as potentially hazardous, especially if it is high-grade ore. Radon gas emanates from the ore and mineral waste as radium decays. It then decays further into solid radon daughters, which are energetic alpha-radiation emitters. Precautions are required at uranium mines to protect the health of workers and the surrounding environment. The air quality as discussed in EQO 5 also plays an important role in relation to health. Adequate monitoring data must be available to assess the performance of the industry.

The National Radiation Protection Authority (NRPA) is a division within the Ministry of Health and Social Services (MHSS). Its objective is to protect human beings (workers, patients and the public), as well as the environment from undue risks, resulting from the harmful effects of ionising radiation, while allowing for its beneficial application in medical, industrial, scientific and other purposes.

Namibian legislation requires that radiation originating from mines is constrained so that the cumulative radiation dose to members of the public is minimized as far as reasonably practicable and does not exceed 1 mSv/a in addition to the natural background radiation. Public dose assessments model the predicted dose to the group of residents that lives closest to the mine, the so-called “critical group”. If several towns or settlements are situated around a mine there can be several critical groups. Some predictions from public dose models can be checked against actual measurements. Radon gas makes a significant contribution to the public dose: The weighted average for the Erongo Region was estimated as 0.5 mSv/a in the SEA report. The SEMP Office therefore monitors and reports public exposure arising from the ambient concentration of radon and short-lived radon progeny at Arandis, Swakopmund and Walvis Bay.

NB: The term “radiation workers” in Target 6.1.2 and Indicator 6.1.2.1 of the SEA report is not defined in the Atomic Energy & Radiation Protection Act (Act No 5 of 2005). Its meaning in this report is the same as the Act’s term “occupationally exposed persons” i.e. all mine workers who may be exposed to ionising radiation at the workplace.

[57] Rössing Uranium Radiation Management Plan 2015

Desired Outcome 6.1.	**Disease rates amongst the public and employees of the mines are not increased as a result of uranium mining.**
Target 6.1.1.	**Increments in the concentrations of uranium, thorium and health-relevant nuclides of the uranium, thorium and actinium decay chains such as Ra-226 and Ra-228 (above respective background concentrations) in air and water (ground and surface) that originate from uranium mines, must be constrained so that the cumulative radiation dose to members of the public is reasonably minimized and does not exceed 1 mSv per annum above background.**
Indicator 6.1.1.1.	**Public dose assessments produced by each new mine project include the cumulative impact of other operating mines.**
Data Source	**NUA/NRPA**
Status:	**IN PROGRESS**

To date the only assessment that considered the cumulative impact of the existing mines and new exploration projects on the public dose was the SEA for the Erongo uranium province.[58] The mines' public dose assessments completed after the SEA only considered the dose to the nearest critical group(s) or the dose at the mine boundaries in the absence of residents in the vicinity.

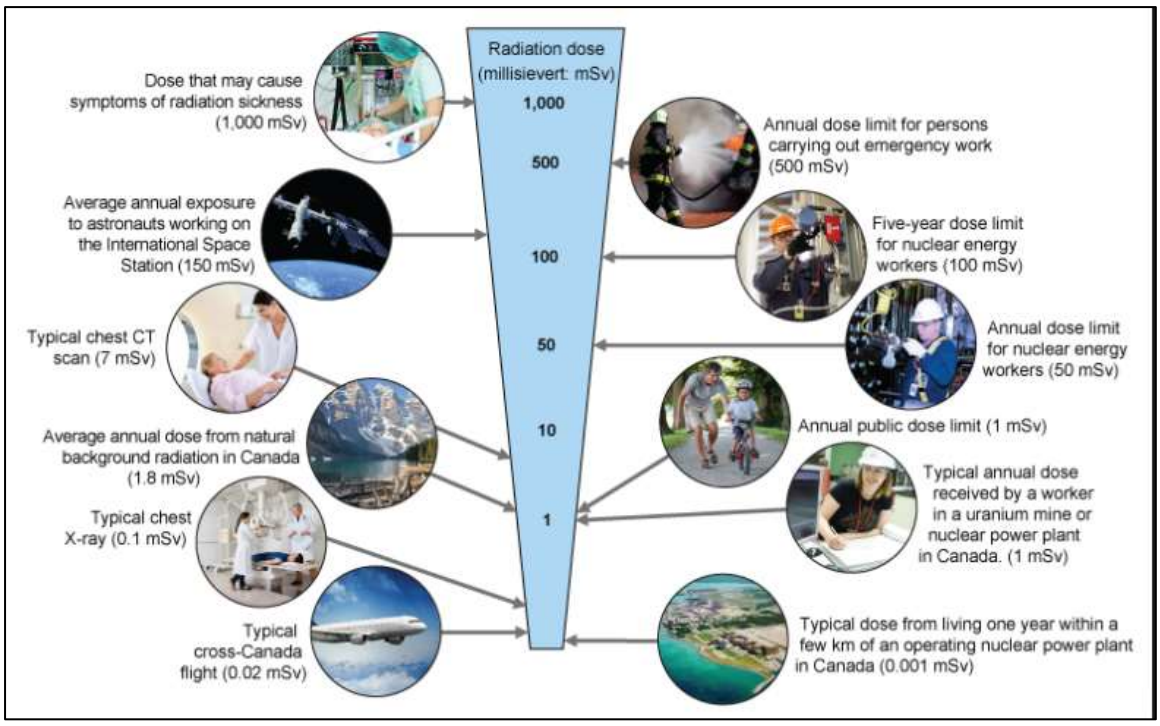

Figure 38: Radiation Dose Examples (Canadian Nuclear Safety Commission)

[58] MME (2010): Strategic Environmental Assessment for the Central Namib Uranium Rush. Ministry of Mines and Energy, Republic of Namibia, Windhoek

Uranium mines are required to report annually regarding the implementation of their Radiation Management Plans (RMP) relating to radiation protection or radiation safety standards, pursuant to Section 29(2) of the Act of the Atomic Energy & Radiation Protection Act, Act No 5 of 2005. This provision is intended to give assurance to the NRPA that the operations are indeed maintained within regulatory requirements as approved in the RMP and its safety assessments. The public dose assessments are evaluated in relation to the potential exposure pathways that reach certain members that are designated as critical groups.[59]

Public doses were assessed based on exposure pathways such as the inhalation of dust and radon progeny and consumption of groundwater or vegetables grown in the area. Seeing that each pathway can potentially reach different critical groups the exposure doses to members of the public contributed by various mines have not yet been clearly defined. There is also a lack of information on radionuclide activities in dust samples collected in public areas and a shortage of baseline data against which new analyses can be compared. This is one of the reasons why the SEMP Office has commissioned the advanced air quality study that will re-evaluate the 2010 air quality model and produce an updated cumulative radiation dose assessment.

Motivation of status: The advanced air quality and radiation study to be completed in 2019 is expected to provide a comprehensive re-assessment of the cumulative impact of all operating mines. Until then the indicator can be rated **IN PROGRESS**.

Indicator 6.1.1.2.	**Modelled cumulative radiation dose to critical groups of the public does not exceed 1 mSv/a above background**			
Data Source	**NUA/NRPA**			
Status:			**MET**	

Mining companies have carried out public dose assessments to determine the additional doses to critical groups or persons present at the mine boundaries (Table 20). The results ranged from 0.0-0.4 mSv/a in addition to the natural background radiation.

Table 20: Public Dose Assessment Results of Various Mines

Company	**Public dose assessment results (mSv/a)**		
	Additional dose at mine boundary	**Additional dose to critical group**	**Critical group location**
AREVA Resources	0.04-0.4	0	Arandis
Bannerman MR	-	1.01 (including background)	Goanikontes warehouse
Langer Heinrich	0.1	0.1	Entrance gate
Rössing Uranium	0.03	0.02	Arandis
Swakop Uranium	0.21	0.21	Contractors' camp, Khan River, Welwitschia plains

[59] NRPA contribution to 2017 SEMP report, 2018

AREVA Resources Namibia: The dose assessment for Trekkopje mine[60] concluded that the main critical group, residents of Arandis, would not be exposed to radioactive dust and radon progeny. The maximum dose to the public was modelled to be 0.04-0.40 mSv for hypothetical groups of people residing at the boundaries of the mining licence. Other potential pathways like ingestion of groundwater were not applicable because the water is naturally saline and unsuitable for consumption. Trekkopje mine is still under care and maintenance and thus not contributing to the cumulative dose in the region.

Swakop Uranium: There are no settlements in the immediate vicinity of the mine, even though the construction camp is still in use (Figure 39). The closest permanent critical groups are smallholdings in the Swakop River, as well as farms situated east and northeast of the mine. The critical groups may potentially be exposed due to inhalation of radioactive airborne dust, inhalation of radon progeny and ingestion of radionuclides by way of consuming food or water.[61] For 2017 the company reported additional doses of 0.21 mSv/a from all pathways to the critical groups.

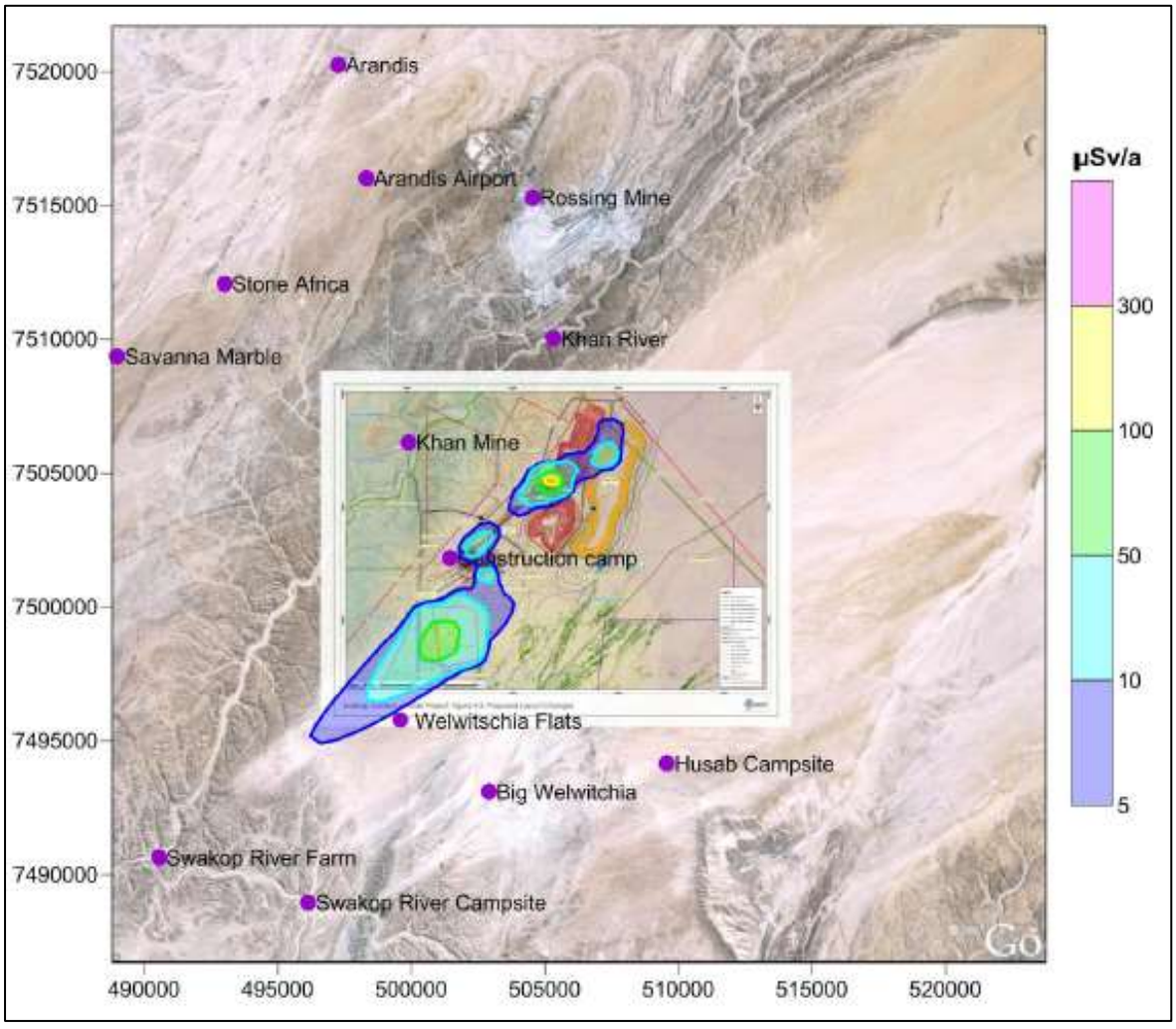

Figure 39: Calculated Doses for External Exposure from Dust Deposition with Mitigation

[60] Blerk, J.J. van and N. Potgieter (2011): Radiological Public Impact Assessment for the Trekkopje Uranium Mine: Swakopmund (Namibia). Report No. ASC-1012B-1 prepared by AquiSim Consulting (Pty) Ltd, Pretoria, South Africa

[61] SLR Environmental Consulting (2013): Environmental impact assessment report amendment for the proposed changes to the Husab mine. SLR Project No. 7NA.13001.00004

Bannerman Mining Resources assessed the public dose due to samples stored at the Goanikontes warehouse to be 1.01 mSv/a including the natural background, i.e. an insignificant additional dose in the order of 0.01 mSv/a.

Langer Heinrich Uranium: The dose to members of the public is estimated for a theoretical group living on the boundary of the mine. The exposure pathway is assumed to be due to long-lived radioactive dust (LLRD), radon gas and external gamma dose which gave a total of 2.1 mSv/a at the Langer Heinrich mine boundary (entrance gate) including the natural background radiation. There are no residents nearby as the mine is situated in the Namib-Naukluft Park and the critical group is a hypothetical group living full-time on the lease boundary. Langer Heinrich Uranium commissioned anemometers at their environmental monitoring stations in 2016 to determine the origin of the long-lived radioactive dust and radon decay products being monitored. The anemometer results at the entrance gate indicate that most of the dust and assessed radiation dose comes from the surrounding desert. From an analysis of the specific activity in the collected dust and a full year's worth of anemometer data it has been determined that there is a small contribution to the radiation dose from the mining operation at the fence boundary. This contribution is from windblown LLRD and radon decay products and has been assessed as 0.1 mSv for 2017.

Rössing Uranium's dose assessment identified the people of Arandis as the critical group.[62] The exposure pathways include the emission of radioactive dust, radon emitted as a result of the mining process and potential groundwater contamination. For potential groundwater contamination there are currently no critical groups that can be affected as the direction of water flow from the mine is toward the Khan River in the south and contamination is well controlled with no impact in the immediate environment.[63] The exposure to the public is considered to be very low to negligible; there has been no change to the mining operation that could increase the exposure compared to 2016.

Radon Monitoring

The SEMP Office has established three radon stations at Arandis, Swakopmund and Walvis Bay that form part of the monitoring network for the advanced air quality study. Table 21 compares data for the year 2017 with readings for 2014 and 2015; there was a data gap in 2016. The Walvis Bay station stopped working in May 2017. It was not replaced because the constant low radon readings measured to date are unlikely to increase in future. The ambient radon concentrations measured in 2017 varied from 8.0 Bq/m^3 at Swakopmund to 17.2 Bq/m^3 at Arandis. Radon is emitted from any type of soil but not from ocean water, so one would expect lower values at the coast.

Table 21: SEMP Radon Monitoring Network Results for 2014, 2015 and 2017

	Average Radon Concentration (Bq/m^3)			Dose (mSv/a)[64]
	2017	**2015**	**2014**	**2016/17**
Arandis	17.2	19.5	20.3	0.4
Swakopmund	8.0	12.7	11.7	0.2
Walvis Bay	4.6	7.9	7.9	0.1

[62] NECSA (2011): Report on the Radiological Public Hazard Assessment for the Expansion of Rössing Uranium Mine in Namibia as a Specialist Study for the Phase II SEIA. Report no. NLM-REP-10/098, Pretoria, RSA

[63] Rössing Uranium RMP, 2016 cited by NRPA

[64] The doses were calculated as follows: Average radon concentration in Bq/m^3 * 0.4 (equilibrium factor between radon and progeny) * 0.00000556 mJ/m^3 (conversion factor) * 1.1 mSv (dose conversion factor) * 8760 hours.

Public doses calculated from the measured data are in the range of 0.1-0.4 mSv/a. These results confirm that the contribution of radon to the public dose at Arandis, Swakopmund and Walvis Bay did not increase compared to the 2010 SEA baseline study.[65]

Motivation of status: The indicator was regarded as **MET**, even though the cumulative dose assessment was still outstanding, because the modelled radiation doses to critical groups were much lower than 1 mSv/a above background. It follows that the cumulative dose would be of the same order of magnitude.

Target 6.1.2.	**The cumulative radiation dose to members of the public and radiation workers does not exceed the legal limit.**			
Indicator 6.1.2.1.	**Measured change in absorbed radiation dose of uranium mine workers.**			
Data Source	**NUA**			
Status:			**MET**	

Uranium mines are required to ensure that occupational radiation exposures are within the regulatory limit of 20 mSv/a in addition to the natural background and that reasonable attempts have been made to minimise all exposures. Also protection and safety must be optimised in order that the magnitude of worker doses, the number of people exposed and the likelihood of incurring exposure are kept as low as reasonably achievable, economic and social factors being taken into account, with the restriction that the doses to individuals delivered by the source be subject to dose constraints. Some mining companies have adopted a dose constraint of 6 mSv/a for optimisation purposes.[66]

Workers are classified as either occupationally exposed persons (OEPs) or non-exposed persons (NOEPs). The OEPs are referred to as radiation workers in this report because they work in areas where they can potentially be exposed to 5 mSv or more in year. The NOEPs work in areas without radiation risk such as offices. Some companies treat all employees as OEPs because their presence on the mine exposes them to higher-than-normal background radiation.

The individual doses shown in Table 22 are calculated by summing all the exposure pathways and all types of radiation exposure. The figures show the mine-wide weighted average doses to all occupationally exposed persons including background and extrapolated to an average working time of 2000 hours per annum. The only exception is Bannerman Mining Resources, where the dose shown in the table excludes the natural background.

The average doses varied between 0.54 mSv/a at Swakop Uranium and 1.2 mSv/a at Langer Heinrich, while the maximum individual doses at operating mines were 3.7-4.9mSv/a. Langer Heinrich Uranium reported an average annual dose to all monitored workers of 1.2 mSv/a. This figure includes workers who were not radiation workers (OEPs) and workers who were not present for the full twelve months of 2017. The theoretical average dose to a person working full-time at Langer Heinrich Mine would have been 1.3 mSv/a in 2017.

[65] MME (2010): Strategic Environmental Assessment for the Central Namib Uranium Rush. Ministry of Mines and Energy, Republic of Namibia, Windhoek
[66] Pers. comm. NUA 2018

Table 22: Radiation Dose to Uranium Mine Workers

Company	Average dose to all occupationally exposed persons (mSv/a)	Number of occupationally exposed workers	Number of workers exposed to >5 mSv/a	Number of workers exposed to >20 mSv/a	Individual maximum dose (mSv/a)
AREVA	0.6	71	0	0	0.7
Bannerman	0.15	8	0	0	0.20
Langer Hein.	1.2	488	0	0	4.9
Reptile MR	0.175	14	0	0	0.13
Rössing U	1.0	1500	0	0	4.2
Swakop U	0.54	1896	0	0	3.7

Motivation of status: None of the measured doses to workers exceeded the limit of 20 mSv/a in 2017. This indicator was therefore **MET**.

Target 6.1.3.	**No measurable increase, directly or indirectly attributable to uranium mining and its support industries in the incidence rates of the following:** • **Industrial lung disease (including pneumoconiosis)** • **Lung cancer and other industrial-related cancers** • **Industrial induced renal damage** • **HIV/ AIDS, tuberculosis** • **Industrial dermatitis**
Indicator 6.1.3.1.	**Measured change in the incidence rate of industrial diseases amongst uranium mine workers.**
Data Source	**NUA**
Status:	**MET**

The information about industrial diseases presented in Table 23 has been obtained from Medixx Occupational Health Services in Swakopmund who carry out occupational medical examinations for all the operating uranium mines and most of their contractors. During 2014-2016 Medixx examined many short-term contractors working on the Husab project. The health profile of this group of employees may be different from that of permanent mine employees. That is why Table 23 shows the industrial disease rates of permanent mine employees, while Table 24 provides a summary of all mine and contractor employees that were examined.

Table 23: New Industrial Disease Cases among Permanent Mine Employees

Disease	2012	2013	2014	2015	2016	2017
Noise-induced hearing loss	1	1	3	0	1	4
Contact dermatitis	4	4	2	2	1	1
Pneumoconiosis	0	0	0	0	0	0
Occupational asthma	0	0	1	0	0	0
Lung cancer	0	1	1	0	0	0
Asbestosis	0	0	0	0	0	0
Industrial-induced renal damage	0	0	0	0	0	0
Number of medical examinations	2801	2563	2358	2727	3171	3702
New cases as % of all examinations	0.2%	0.2%	0.3%	0.1%	0.1%	0.1%

Five new cases of industrial disease were detected in 2017. The number previously varied from 2-7 cases per year among permanent mine employees and 7-18 if contractors are included. The incidence rate in 2017 was 0.06-0.1%. The most common cases were noise-induced hearing loss and contact dermatitis, a skin complaint caused by prolonged exposure to chemicals or other irritants.

Table 24: New Industrial Disease Cases among Mine and Contractor Employees

Disease	2012	2013	2014	2015	2016	2017
Noise-induced hearing loss	1	8	9	6	5	4
Contact dermatitis	4	7	5	6	3	1
Pneumoconiosis	1	2	0	0	0	0
Occupational asthma	0	0	1	0	1	0
Lung cancer	1	1	1	1	2	0
Asbestosis	0	0	1	0	0	0
Industrial-induced renal damage	0	0	0	0	0	0
Number of medical examinations	9920	9820	12049	15197	11784	8589
New cases as % of all examinations	0.1%	0.2%	0.1%	0.1%	0.1%	0.06%

HIV/AIDS and tuberculosis (TB) occur among all sectors of the population and are only defined as industrial diseases if workers are infected under specific circumstances. For instance, in South Africa TB is recognised as an industrial disease if contracted by underground mine workers who have been exposed to high levels of silica in dust.[67] HIV/AIDS has been identified as a problem among mine workers who live in hostels far from their families and may therefore engage in unsafe sexual practices. This situation does not apply to the Namibian uranium industry where employees live with their families in established towns. The only exception is during the construction phase when large numbers of contractor employees are accommodated in temporary camps.

[67] Ministry of Health and Social Services, National Tuberculosis and Leprosy Programme, Annual Report 2015-2016

Table 25: New HIV and TB Cases among Permanent Mine Employees

	2012	2013	2014	2015	2016	2017
Newly diagnosed HIV cases (self-reported)	1	2	0	2	1	2
Rate of newly reported HIV cases per 100 000	36	78	0	73	32	54
Known HIV cases (diagnosed during lifetime)	7	56	50	49	59	70
Percentage of known HIV+ cases	0.2%	2.2%	2.1%	1.8%	1.9%	1.9%
Newly diagnosed TB cases	3	0	1	5	2	7
Rate of new TB cases per 100 000	**107**	**0**	**42**	**183**	**63**	**189**
Known TB cases (diagnosed since birth)	8	6	15	54	94	120
Rate of known TB cases per 100 000	286	234	636	1980	2964	3241

The reported HIV infection rate of 1.9% for mine employees (Table 25) and 2.7% including contractors (Table 26) is much lower than the national average of 17-19% during the reporting period. The figures may however be too low because they are based on voluntary self-reporting by workers. HIV testing is not included in the scope of occupational medical examinations, but can be conducted if a person wants to be tested.[68]

The most recent Namibian national rate of new TB cases was 449 per 100 000, while the most recent rate of new TB cases in the Erongo Region was over 1000 per 100 000.[69] The rate of new cases diagnosed at the uranium mines in the Erongo Region increased to 189 per 100 000 permanent employees (Table 25) and 163 per 100 000 if contractor employees are included (Table 26), indicating that TB is still a problem in the Erongo Region.

Table 26: New HIV and TB Cases among Mine and Contractor Employees

	2012	2013	2014	2015	2016	2017
Newly diagnosed HIV cases (self-reported)	20	3	8	10	16	10
Rate of newly reported HIV cases per 100 000	202	31	66	66	136	116
Known HIV cases (diagnosed during lifetime)	276	216	327	378	323	229
Percentage of known HIV+ cases	2.8%	2.2%	2.7%	2.5%	2.7%	2.7%
Newly diagnosed TB cases	15	2	4	19	10	14
Rate of new TB cases per 100 000	**151**	**20**	**33**	**125**	**85**	**163**
Known TB cases (diagnosed since birth)	27	32	136	550	451	355
Rate of known TB cases per 100 000	272	326	1129	3619	3827	4133

Motivation of status: The indicator to be measured is the change in the incidence rate of industrial diseases amongst uranium mine workers. Looking at the number of recognised industrial disease cases in Table 23 and Table 24 it is evident that the rate has remained around 0.1-0.2% during the period from 2012 to 2017, with an exception of 0.3% in 2014. The absence of an increasing trend means that the indicator has been **MET**.

[68] Pers. comm. Medixx Occupational Health Services, 2017

[69] www.mhss.gov.na/files/downloads/c38_NTLP%20Annual%20Report%202015.05.pdf

Indicator 6.1.3.2.	Measured change in the incidence rate of diseases scientifically attributed to radiation amongst members of the public and uranium mine workers.
Data Source	NUA
Status:	IN PROGRESS

Rössing Uranium has commissioned a comprehensive epidemiological study of former and current employees of the mine, from which conclusions about the incidence rate of radiation-related diseases may be drawn. Preparations for the epidemiological study on the potential effects of occupational radiation exposures on mine workers, designed to stand up to scientific scrutiny, began in 2011.

The scoping for the study, which included an investigation on the available data and the study designs possible, was concluded in 2015. The study project was awarded to the Centre for Occupational and Environmental Health at the University of Manchester in the UK and the study kicked off in October 2015. The study design, chosen for best statistical power, was that of a "case-cohort" study, where a sub-group of the workers who have been diagnosed with specific cancers of interest (the cases) are compared with a larger subgroup of workers (the cohort).

The company embarked on a media campaign to inform former workers about the study and to allow them to withdraw their consent for the use of their data, although all data was anonymised. They obtained ethics approval from the Ministry of Health and Social Services, from the University of Manchester and from the South African cancer registry, based on the study design submitted. An external oversight committee, consisting of community leaders and Government representatives was appointed to provide external input and oversight.

The study team also works with the Namibian and South African cancer registries to identify as many cancer cases within the workforce as possible to achieve statistically valid results. The study design ensured that all information about cancer cases was anonymised before it was communicated to the research team, so that no personal information was conveyed.

The collection of human resources data and cancer data from the cancer registries and gathering of the relevant occupational hygiene data for the past 40 years was completed in 2017. The statistical analysis of this information will be completed in 2018, with a final report expected towards the end of 2018.[70]

Motivation of status: The Rössing Uranium epidemiological study aims to determine whether there is an excess, work-related cancer risk for uranium miners,[71] which will indicate whether there is a higher incidence rate of diseases scientifically attributed to radiation amongst uranium mine workers. Seeing that the study started in 2015 and is expected to be completed in 2018 the indicator was rated **IN PROGRESS**.

[70] Rössing Uranium Limited (2018): Consolidating for success - Report to stakeholders 2017
[71] Werner Duvenhage, Rössing Uranium, media briefing on 26 February 2016

Desired Outcome 6.2.	**Improved healthcare facilities and services are able to meet the increased demand for healthcare resulting from uranium mining.**
Target 6.2.1.	**An increase in qualified health workers available to all in the Erongo Region, reaching 2.5 per 1000 of the population by 2020.**
Indicator 6.2.1.1.	**Number of available qualified healthcare personnel: 2.5 per 1000 of population;** **Number of Medical Practitioners: 1 per 1000 of population;** **Number of Dental Practitioners: 1 per 2000 of population;** **Number of nurses: 2.5 per 1000 of population;** **Pharmacists: 1 per 2000 of population.**
Data Source	**SEMP Office/MHSS**
Status:	**NOT MET**

Target 6.2.2.	**An increase in registered healthcare facilities in Erongo, available to all, reaching 2.5 acute care beds per 1000 population and 0.5 chronic care beds per 1000 population by 2020.**
Indicator 6.2.2.1.	**Number of available registered healthcare facilities: 1 per 1000.**
Data Source	**SEMP Office/MHSS**
Status:	**NOT MET**

Target 6.2.3.	**An increase in ambulances in Erongo, reaching 1 per 20,000 by 2020.**
Indicator 6.2.3.1.	**Number of available ambulances: 1 per 20,000.**
Data Source	**SEMP Office/MHSS**
Status:	**NOT MET**

Namibians have access to three types of health services: public, private and not-for-profit healthcare systems. Only 15% of the country's population, mostly middle and high income earners can afford private healthcare services, while 85% of the population uses public and non-profit health care facilities. Certain services like organ transplantations are only available from private medical centres, putting them out of reach of the majority of Namibia's citizens.

Ensuring the provision of quality health care is one of the most important goals of the Ministry of Health and Social Services (MHSS). The Ministry in its Strategic Plan for 2017/2018 to 2021/2022 reconfirms its commitment to capacity building and skills development of health workers to provide quality essential services.[72] Table 27 sets out the planned targets for the number of patients per health worker. The plan does not specify the desired number of dentists, health care facilities or ambulances.

Table 27: MHSS Planned Ratio per Population

	Baseline	2017/18	2018/19	2019/20	2020/21	2021/22	SEMP
Nurses	328	317	307	297	285	270	400
Pharmacists	4095	3563	3286	2922	2567	2289	2000
Doctors	2485	2224	2012	1837	1625	1457	1000

According to these figures, the SEMP indicator of 2.5 nurses per 1000 has already been reached – though one should note that these figures apply to the entire country, not only the Erongo Region. The indicators for doctors (1:1000) and pharmacists (1:2000) will not be met, though the projected 2021/22 figures may come close enough to the target.

According to an article published in 2018, government needs over 470 doctors in order to meet the required international (United Nations) standards, i.e. one doctor per 5000 patients. There are 354 doctors at state hospitals across the country and according to the health minister it would take Namibia 25 years to meet the requirement. Out of 35 hospitals in all regions 23 need additional doctors. Only seven hospitals had a sufficient number of doctors (Nyangana, Tsumeb, Opuwo, Outjo, Karasburg, Okahandja ,Windhoek Central) and five had over 50% of the requirement (Khorixas, Grootfontein, Otjiwarongo, Andara, Keetmanshoop). In the Erongo Region, the Swakopmund and Walvis Bay hospitals need nine more doctors while the Omaruru and Usakos hospitals need three doctors each.[73]

A regional picture emerged from the Workload Indicators of Staffing Need (WISN) exercise that MHSS conducted in 2015 to generate evidence to inform the Ministry's staffing decisions.[74] The report stated that staffing norms in Namibia had not been revised in over ten years. This fact, along with the general shortage of certain cadres, necessitated that the MHSS review both the staffing norms and number of health workers. The WISN method was applied to all 13 regions in Namibia and focused on four particular categories of health workers that MHSS perceived to be the most critical, i.e. doctors, dentists, nurses, pharmacists and pharmacist assistants (Table 28).

Table 28: Public Health Professionals in the Erongo Region

	Doctor		Dentist		Pharmacist		Pharmacist assistant		Registered nurse		Enrolled nurse	
Health District	Actual	Required	Actual	Required	Actual	Required	Actual	Required	Actual	Required	Actual	Required
Omaruru district	3	4.6	0	0.8	0	2.8	1	2.5	0	33	0	30
Swakopmund district	5	14	2	1	0	4.3	4	6.7	49	64	27	43
Usakos district	2	4.7	0	2	0	2.8	1	4.2	24	36	16	30
Walvis Bay district	4	14	3	1	0	4.5	2	9.3	12	89	9	69
Total	**14**	**37**	**5**	**5**	**0**	**14**	**8**	**23**	**85**	**223**	**52**	**172**
Target ratio per 1000	1:1000		1:2000		1:2000		1:2000		2.5:1000		2.5:1000	
Actual ratio per 1000	1:12550		1:35150		None		1:22000		1:2070		1:3380	

[72] Ministry of Health & Social Services: Strategic Plan 2017/2018 – 2021/2022, www.mhss.gov.na

[73] Article by Okeri Ngutjinazo "Govt needs 470 doctors to meet standards" in The Namibian of 5 March 2018

[74] MHSS (2016): Namibia National WISN Report 2015: A Study of Workforce Estimates for Public Health Facilities in Namibia. Report by IntraHealth International-Namibia on behalf of MHSS, Windhoek

The WISN results estimate the number of health professionals required according to national practice standards in Namibia. The results of the WISN application raised concerns around the quality of health service provision. The results have been used to make policy recommendations to the MHSS, e. g. increasing the number of positions where there are critical shortages, redistributing existing staff, reviewing health facility classifications, promoting appropriate task sharing, introducing a new staff, focusing on competency training, reviewing health information systems indicators, and basing all policy on health service priorities.

Currently, the Erongo Region's public health infrastructure consists of 21 clinics, 1 health centre and 5 hospitals. Table 28 summarises the WISN results for the Erongo Region compared to the SEMP targets. It also shows the target ratios of health care professionals against the actual numbers in 2015, assuming a population of 175,750 in Erongo[75].

Ten times more doctors and pharmacists or pharmacist assistants would be needed to meet the required ratios. The WISN report regarded the number of five dentists in Erongo as adequate, even though the ratio is only 1:35,150. If the number of registered and enrolled nurses is combined the actual ratio is 1:1280, which is still far from the desired coverage of 1 per 400 persons (2.5:1000).

The number of healthcare facilities was 27 for 175,750 inhabitants, which translates to an actual ratio of 1:6500 compared to the desired target of 1:1000. The indicator proposes one ambulance per 20,000 inhabitants, i.e. nine for the region. The actual number was not given in the MHSS reports. The private healthcare figures are closer to the desired targets, but they were not reviewed because the facilities are not accessible to all.

Motivation of status: The due date for these indicators is approaching and the MHSS strategic plan does not make provision for the required number of doctors and pharmacists to be recruited. It therefore appears doubtful whether the indicators will be met by the year 2020, especially taking into consideration the state's budget constraints that may prevent significant progress in the coming two years. The indicators were therefore regarded as **NOT MET** for 2017.

[75] NSA (2016): Presentation-NIEHS 2015-2016 Preliminary Indicators, www.nsa.org.na.

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Summary of performance: EQO 6

Total no. indicators assessed	8			
	NOT MET	**IN PROGRESS**	**MET**	**EXCEEDED**
Number of indicators in class	3	3	2	0
Percent of indicators in class	37.5%	37.5%	25%	0%

Overall performance: Two indicators were **MET** (25%), i.e. the radiation dose to workers at mines did not exceed the legal limit and the incidence of occupational diseases did not increase. The three indicators **IN PROGRESS** (37.5%) are related to public dose assessments that will be re-assessed as part of the advanced air quality study and the Rössing Uranium epidemiological study. The three indicators measuring the ratio of healthcare professionals and facilities per number of population were regarded as **NOT MET** (37.5%) because the MHSS strategic plan for the next five years does not make provision for the required numbers in the year 2020.

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EQO 7. Effect on Tourism

Aims of this EQO:

- **The natural beauty of the desert and its sense of place are not compromised unduly by uranium mining; and to identify ways of avoiding conflicts between the tourism industry and prospecting/mining, so that both industries can coexist in the Central Namib.**
- **Uranium mining does not prevent the public from visiting the usually accessible areas in the Central Namib for personal recreation and enjoyment; and to identify ways of avoiding conflicts between the need for public access and mining.**

The direct contribution of travel and tourism to GDP was N$4,938 million in 2017, 2.9% of total GDP and this is forecast to rise to 3.7% by 2028. The total contribution of tourism to GDP was N$23,775 million or 13.8% of GDP. In 2017 tourism directly supported 23,000 jobs (3.2% of total employment), which is forecast to rise to 35,000 jobs (3.6% of total employment) in 2028. The total contribution of the industry to job creation was 14.0% of total employment (98,000 jobs). Visitor exports generated N$4,370 million, while investment in tourism was N$4,426 million, 12.0% of total investment.[76]

These few figures collected by the World Travel & Tourism Council highlight the importance of tourism to the Namibian economy. The number of foreigners, including business travellers, arriving in Namibia increased from 1.46 million in 2016 to 1.57 million in 2017.[77] Many of these arrivals were from Angola, South Africa, Zambia, Germany, Zimbabwe, Botswana, the USA and France. Most international travellers spend a few nights at the coast and take part in leisure activities, which make an important contribution to the economy of the Erongo Region (Figure 40).

Figure 40: Quadbiking in the Dunes at Swakopmund (Swakopmund Day Trips via Google)

[76] World Travel & Tourism Council (2018): Travel & Tourism Economic Impact 2018 – Namibia
[77] Namibian Statistics Agency 2017

To ensure that visitors will be able to enjoy the natural beauty of the desert and its sense of place EQO 7 advises the uranium mining industry to reduce its visual impact and to identify ways of avoiding conflict between tourism and prospecting/mining, so that both industries can coexist in the Central Namib. Uranium mining should not prevent the public from visiting the usually accessible areas in the Central Namib for personal recreation and enjoyment. A compromise has to be found between the public's need for access and the mines' requirement to safeguard their properties against unauthorised incursions.

Desired Outcome 7.1.	**Central Namib is accessible to the public (within the regulations of the National Parks).**
Target 7.1.1.	**Uranium mining does not result in net loss of publicly accessible areas.**
Indicator 7.1.1.1.	**Areas of importance for recreation that are not yet alienated by mining or prospecting are declared 'red flag' for prospecting or mining. These include: The Walvis-Swakop dunes, Messum Crater, Spitzkoppe (Gross and Klein), Brandberg, the Ugab, Swakop, Khan, and Kuiseb rivers, the coastal area between the Ugab River mouth and the tidal mud banks south of Sandwich Harbour (between lower mark and the main coastal road), the Welwitschia Drive and Park campsites.**
Data Source	**NERMU/NUA**
Status:	**NOT MET**

The SEA envisaged that areas of importance for recreation would be red or yellow flagged, meaning that mining or prospecting activities would not be permitted in red-flagged areas and special conditions would be imposed in yellow-flagged areas (Figure 41).[78] Some of the areas identified in this indicator are situated in national parks and thus fall under the ambit of the National Policy on Prospecting and Mining in Protected Areas (refer to EQO 8 for background on the policy).[79]

Table 29 indicates in which listed areas mining activities will be prohibited once the policy has been approved. Mining will not be allowed along the Kuiseb and Ugab rivers and along the entire coast. The policy will protect three yellow-flagged areas, but does not give specially protected status to the Swakop and Khan rivers, Welwitschia drive, Moon landscape and park campsites (Figure 42 and Figure 43).

None of the four red-flagged areas will be protected by the policy. The Messum Crater, Brandberg, Gross and Klein Spitzkoppe are located outside of national parks, but within the communal Tsiseb and #Gaingu conservancies. The Brandberg and the rock paintings at Spitzkoppe have however been declared national monuments (* in Table 29). MME allows mining in conservancies, though it should also be approved by the conservancy committee and relevant traditional authority.

[78] MME (2010): Strategic Environmental Assessment for the Central Namib Uranium Rush. Ministry of Mines and Energy, Republic of Namibia, Windhoek

[79] National Policy on Prospecting and Mining in Protected Areas

Table 29: Protection Status of Central Namib Tourism Hotspots

EQO 7 Tourism Area	Protected Area Name	Flag	Policy prohib-its mining?[80]
Walvis-Swakop dunes	Dorob National Park	Red	No
Messum Crater	Dorob, Tsiseb Conservancy	Red	No
Spitzkoppe (Gross and Klein)	#Gaingu Conservancy	Red	Partly*
Brandberg	Tsiseb Conservancy	Red	**Yes***
Ugab River	Dorob and Tsiseb	Yellow	**Yes**
Swakop/Khan River	Namib Naukluft NP	Yellow	No
Kuiseb River	Namib Naukluft, Dorob	Yellow	**Yes**
Coastal area from Ugab River mouth to tidal mud banks south of Sandwich Harbour	Namib Naukluft and Dorob National Parks	Yellow	**Yes**
Welwitschia drive	Namib Naukluft NP	Yellow	No
Moon landscape	Namib Naukluft NP	Yellow	No
NNNP campsites	Namib Naukluft NP	Yellow	No

MET:DEA reported that the new Parks and Wildlife Act may give the Minister the power to refuse environmental clearance for mining projects in red and yellow flagged areas.[81]

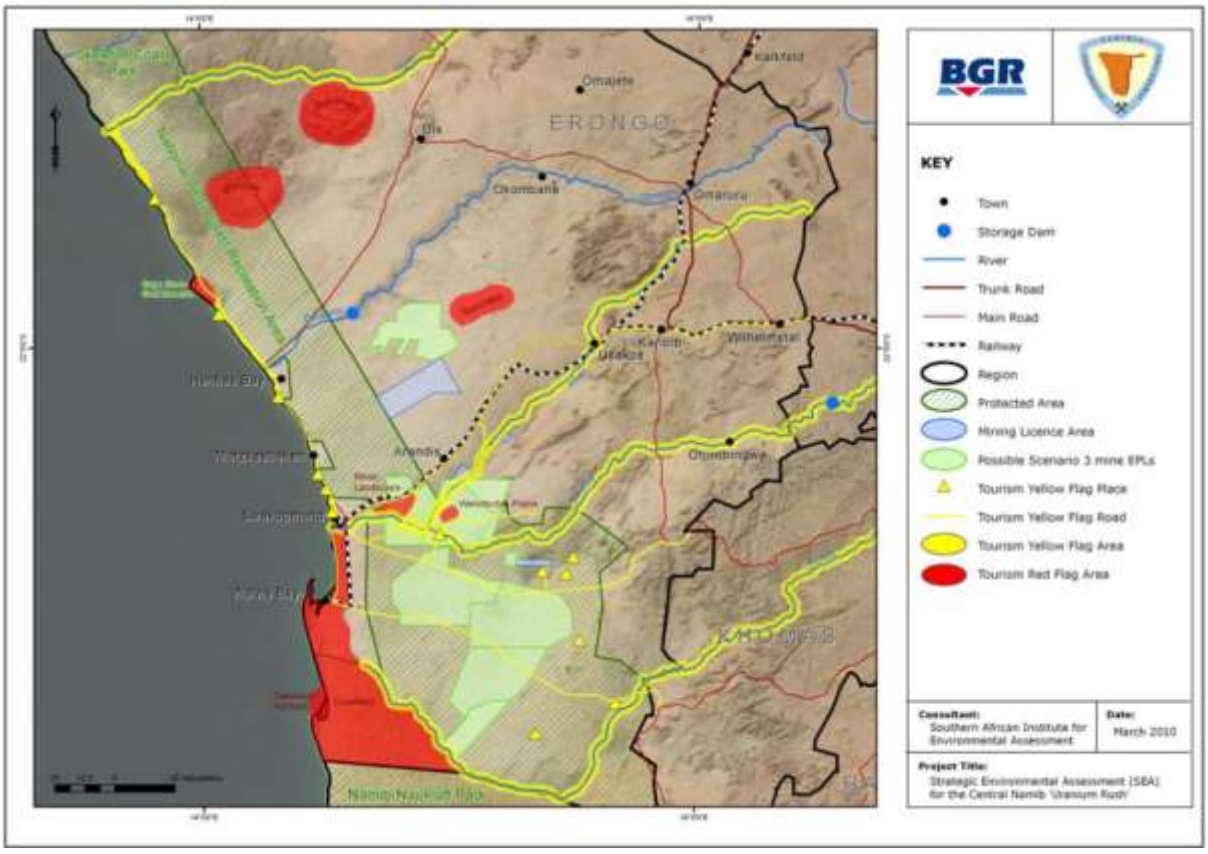

Figure 41: Red and Yellow Flag Tourism Areas

[80] National Policy on Prospecting and Mining in Protected Areas
[81] Pers. comm. MET, SEMP SC meeting April 2018

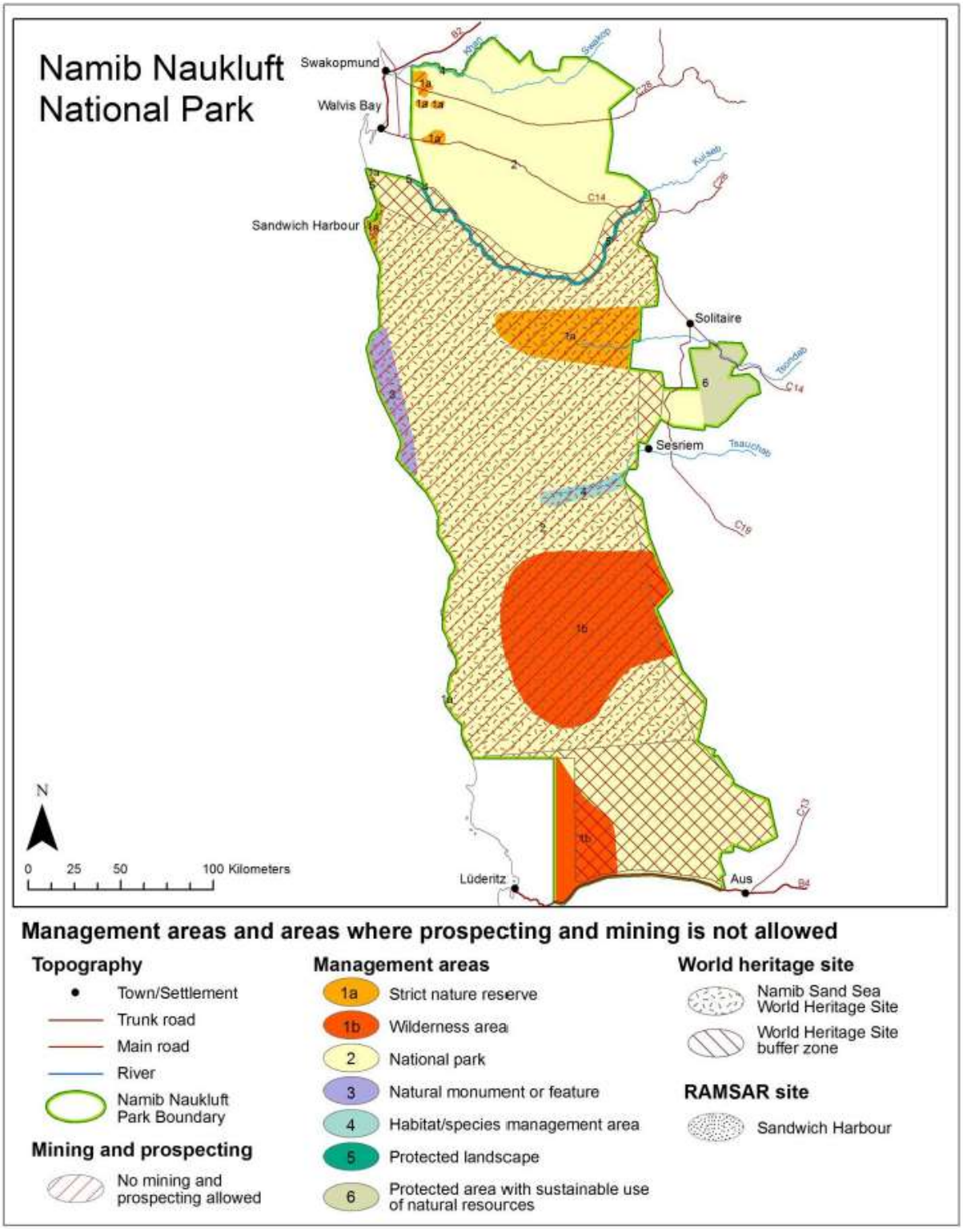

Figure 42: Protected Areas of the Namib Naukluft National Park

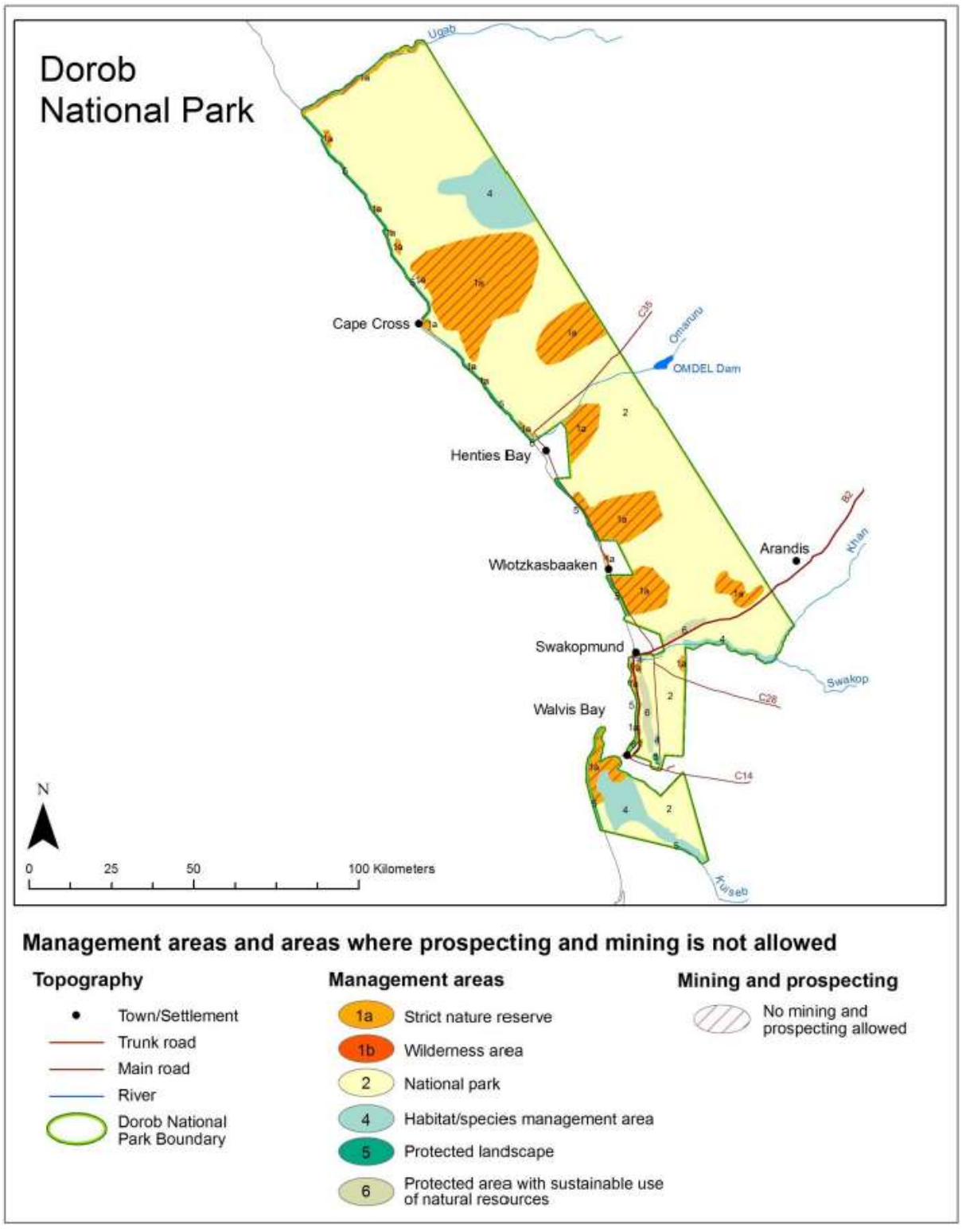

Figure 43: Protected Areas of the Dorob National Park

Motivation of status: The red-flagged recreation areas listed in the indicator and most of the yellow-flagged areas have been excluded from the final draft of the prospecting and mining in protected areas policy. It is not clear if areas outside of national parks can be protected by means of refusing environmental clearance. Seeing that some of the most important tourism areas will not be protected the indicator was regarded as **NOT MET**.

Indicator 7.1.1.2.	**EIAs for all new listed mineral developments address the issue of public access.**			
Data Source	**NERMU/NUA**			
Status:				

NUA reported that none of its member companies had carried out EIAs for new mineral developments in 2017.

Motivation of status: The indicator was **NOT APPLICABLE.**

Indicator 7.1.1.3.	**Mine closure plans and environmental contracts of exploration companies address public access after project closure.**			
Data Source	**NERMU/NUA**			
Status:			**MET**	

To evaluate this indicator, one has to distinguish between operating mines and exploration companies. The latter can rehabilitate exploration drilling and trenching sites to restore public access without any restrictions and this has in fact happened as reported by Bannerman Mining Resources, Reptile Mineral Resources and Exploration, Rössing Uranium (Z20 area), Valencia Uranium and Zhonghe Resources (Namibia) Development. Swakop Uranium has addressed this requirement as per current approved EMP for exploration activities. Once work at exploration sites is completed, the roads are closed off and rehabilitated where required. Public access is never restricted during exploration activities apart from the road to the drill site and physical drill site.

Even though the full restoration of public access after closure of an operating mine would be ideal, the radioactive nature of the remaining mineral waste will generally require the public to be excluded from waste storage facilities and in the case of Rössing also from the open pit, which will remain unfilled. In terms of the IAEA standards for uranium mining waste management and international good practice, public access to an open pit backfilled with tailings would only be permitted if a tailings cover was in place and designed to reduce the radon emanation to such an extent that a person living on the site would be exposed to less than the public dose limit of 1 mSv/a above the natural background.

EQO 7 specifies that uranium mining should not prevent the public from visiting the usually accessible areas in the Central Namib for personal recreation and enjoyment. It should be noted that Rössing Uranium has not been accessible for the last 40 years and the Langer Heinrich Uranium area has been out of bounds since the Namib Naukluft Park was proclaimed in 1979. Even if sections of these mine sites were to remain cordoned off after mine closure it would not result in a net loss in usually accessible areas (as per Target 7.1.1).

Motivation of status: Exploration companies have rehabilitated their sites and mining companies have made provision for public access to the extent that is feasible in their closure plans. The indicator was **MET**.

Desired Outcome 7.2.	**Uranium mining does not significantly reduce the visual attractiveness of the Central Namib.**			
Target 7.2.1.	**Direct and indirect visual scarring from uranium mining is avoided or kept within acceptable limits.**			
Indicator 7.2.1.1.	**Tour operators continue to regard areas such as the dunes, the coastline, Moon Landscape, Welwitschia Flats, Swakop and Khan River areas, and Spitzkoppe as a 'significant' component of their tour package.**			
Data Source	**CTAN, NERMU, Ministry of Environment and Tourism**			
Status:			**MET**	

Evidence presented in this section is based on a survey of the relevant operators' tour packages that were advertised on the internet in 2017. Trips along the coast, to the dunes, Moon Landscape, Bloedkoppie and Giant Welwitschia were offered by Living Desert Adventures, Charly's Desert Tours and Tommy's Tours, among others. Turnstone Tours and Swakop Tour Company conducted day trips to the Khan and Swakop River valleys. Sightseeing flights over the desert also remained very popular.

Motivation of status: Because the relevant tour operators were still offering trips to the listed attractions as a significant component of their tour packages in 2017, the indicator was **MET.**

Indicator 7.2.1.2.	**Tourists' expectations are 'MET OR EXCEEDED' more than 80% of the time in terms of their visual experience in the Central Namib.**			
Data Source	**NERMU/NUA**			
Status:				**EXCEEDED**

The SEMP steering committee decided at its April 2017 meeting that the use of internet sites that allow tourists to give feedback on their travel experience was an appropriate data collection method for this indicator. The most widely used platform with thousands of reviews related to Namibia is TripAdvisor (www.tripadvisor.com). The site contained many reviews of the Erongo Region, which included self-drive and guided desert tours. To access the detailed reviews one has to search each of the listed attractions or tour companies. The relevant options are listed in Table 30 together with the number of ratings in the various categories. There are more tour operators in the region, but not all of them were reviewed on TripAdvisor. Namibia Tours & Safaris operates in the region and country-wide, it was not possible to separate the large number of reviews. Another limitation is that only reviews in English could be evaluated, resulting in a total of 1023 reviews.

One reviewer wrote about the Moon Landscape: *"This trip is a must when in Swakopmund. The scenery is really like the moon photos. Roads are well maintained."* People who gave "poor" or "terrible" ratings were mostly disappointed by their tour guides, the number of animals seen or the cost of the trip. Nobody mentioned negative impressions of the desert landscape.

Table 30: Tourist Ratings of Uranium Province Trips on TripAdvisor

Name	Excellent	Very good	Average	Poor	Terrible	Total
Welwitschia Plains	96	51	26	1	1	175
Moon Landscape	3	2	0	0	0	5
Living Desert Adventures	143	17	6	1	1	168
Charly's Desert Tours	65	15	1	1	0	82
Namibia Tours & Safaris	404	45	6	3	2	460
Desert Tracks Tours	18	1	0	1	0	20
Batis Birding Trips	73	5	0	2	2	82
Eagle Eye Aviation	17	5	2	3	4	31
Total	**819**	**141**	**41**	**12**	**10**	**1023**

TripAdvisor has a function that allows the reviews to be searched for key words. To find out about the impact of mining activities, the reviews were checked for the words "uranium", "mining", "mine" and "tracks". None of the recent reviews mentioned any of these key words, probably because there was not much drilling in the parts of the Namib-Naukluft Park that tourist visit. Some tours visited salt and mica mines and reviewers rated them as "amazing". Even looking at the possibility that tourists taking scenic flights, e.g. from Swakopmund to Sossusvlei, could easily see tracks across the desert from exploration activities did not turn up any negative reviews.

Motivation of status: Tourists did not publish critical reviews about uranium mining in 2017. The excellent and very good ratings add up to 94% while the indicator only requires more than 80%. The indicator was again **EXCEEDED**.

Indicator 7.2.1.3.	**All EIAs for mine development address visual impacts and sense of place.**			
Data Source	**NERMU/NUA/MET**			
Status:			**MET**	

Swakop Uranium commenced with amendments to the linear infrastructure EIA and amendments to the Husab Mine and associated infrastructure EIA in August 2017. The first amendment concerns additional telecommunication antenna poles along the Husab access road, while the second amendment for the Husab Mine and associated infrastructure includes the expansion of the waste rock dump and the installation of an on-site incinerator for waste management. The EIA scoping report takes into account visual impacts and sense of place.

Motivation of status: The indicator was **MET**.

Desired Outcome 7.3.	**Areas of significant natural beauty or sense of place are afforded proper protection (without undermining existing legal rights).**
Target 7.3.1.	**Improved protection of listed areas.**
Indicator 7.3.1.1.	**MME recognizes and respects 'red flag' status for areas regarded as being significantly beautiful.**
Status:	

Indicator 7.3.1.2.	**MME recognizes and respects 'yellow flag' status for areas regarded as being scenically attractive.**
Data Source	**NERMU/MME**
Status:	

Indicator 7.3.1.3.	**No new mining and prospecting licences are awarded in the red and yellow flag areas as identified by the SEA.**
Data Source	**NERMU/NUA**
Status:	

Indicators 7.3.1.1, 7.3.1.2 and 7.3.1.3 refer to the red and yellow flagged areas as identified in the SEA report (Figure 41). It is expected that MME will be guided by the National Policy on Prospecting and Mining in Protected Areas that is still awaiting submission to Cabinet. However, as described under Indicator 7.1.1.1, the policy does not cover all the red and yellow-flagged areas that were identified in the SEA. Whether or not the Parks and Wildlife Act will enable MET to prevent mining in these areas will only become apparent once new EPLs and MLs are issued. One new mining licence was issued in 2017, but the project is not situated in a red or yellow-flagged area.

Motivation of status: The three indicators were **NOT APPLICABLE** because there were no applications for licences in red or yellow flagged areas in 2017.

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Summary of performance: EQO 7

Total no. indicators assessed: 5 (4 were **NOT APPLICABLE**)

	NOT MET	IN PROGRESS	MET	EXCEEDED
Number of indicators in class	1	0	3	1
Percentage of indicators in class	20%	0%	60%	20%

Overall performance: The indicator gauging tourists' experience of the Namib was again **EXCEEDED** (20%) and three indicators were **MET** (60%), showing that tourism operators and mining industry are able to coexist in the Central Namib. Even though the indicator concerning the protection of tourism hotspots was **NOT MET** (20%), it seems that conflict between the need for public access and mining has so far been avoided and uranium mining did not prevent the public from visiting the usually accessible areas in the Central Namib for personal recreation. Indicators related to EIAs and issuing of licences were **NOT APPLICABLE**.

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EQO 8. Ecological Integrity

Aims of this EQO: The ecological integrity and diversity of fauna and flora of the Central Namib is not compromised by uranium mining. Integrity in this case means that ecological processes are maintained, key habitats are protected, rare and endangered and endemic species are not threatened. All efforts are taken to avoid impacts to the Namib and where this is not possible, disturbed areas are rehabilitated and restored to function after mining/development.

There are major overlaps in the location of rare species, critical biodiversity areas and the presence of minerals in Namibia. The potential negative impacts of exploration and mining activities can be devastating to biodiversity and ecosystems. Landscape alteration, soil and water contamination and the loss of critical habitats can lead to the loss of important and endemic plant and animal species, which can compromise ecosystems and reduce tourism potential. While a number of strategies were employed to address exploration and mining activities in protected areas, it had become evident that strong policy frameworks and tools had to be developed to improve decision-making and provide protection for biodiversity, ecosystem services and cultural heritage from development impacts.

It is on this basis that MME and MET developed a National Policy on Prospecting and Mining in Protected Areas. The vision of the policy is to allow sustainable prospecting and mining in Namibia to support economic growth, whilst maintaining the integrity of ecosystems and natural resources, and avoiding degradation of highly sensitive areas of ecological, social or cultural heritage value. This is to be achieved through the identification of ecologically and culturally sensitive areas within Namibia's protected areas, including the red and yellow flagged areas identified in the uranium province SEA.[82] Supportive measures to enhance the areas' protection include improved decision-making in the awarding of exploration and mining licences. Approval of the policy by parliament will be a major step forward in meeting several targets and indicators of EQO 7, EQO 8 and EQO 10. The final draft of the policy was completed in early 2018.

The assessment of indicators within this EQO in annual SEMP reports offers the residents of the uranium province an opportunity to review and understand the cumulative impacts of uranium mining on their ecological environment. The reports also allow stakeholders to track the progress of actions taken to collectively address concerns about likely impacts on biodiversity including rare, endangered and endemic species, and other aspects of ecological integrity such as the protection of ecological processes and key habitats.

Feedback from previous SEMP reports confirmed that the central Namib's conservation objective of species diversity and integration remained a priority, and that efforts by both the regulating authorities and mining companies were made to avoid, mitigate or rehabilitate mining impacts. Continued monitoring of the extent of direct impacts and the measures put in place to ensure persistence of all species remains relevant, even though the pace of new mine development has slowed down considerably in the last three years.

Biodiversity conservation in parts of the central Namib without uranium mining remains a challenge. Uncontrolled urban development along the coast continues to exert pressure on the natural environment, despite NACOMA's efforts to put in place a National Policy on Coastal Management.

[82] MME (2010): Strategic Environmental Assessment for the Central Namib Uranium Rush. Ministry of Mines and Energy, Republic of Namibia, Windhoek

Case Study – Invertebrate Monitoring at Rössing Uranium

Rössing Uranium is committed to biodiversity protection by considering ecological values and land-use aspects in investment, operational and closure activities. One of the highlights of 2017 was the continuation of the invertebrate monitoring programme by means of the pitfall trapping method in the wider landscape. The focus was on the rocky hillside within our licence area that has not been sampled in the past. The results showed that 22% of the species recorded in 2017 (48 out of 212) had not been found in 2016. They were generally less common species than those initially found, confirming that the increased sampling effort was effective.

Environment Advisor Loide Hausiku setting up a Pitfall Trap (Photo by Rössing)

Invertebrate is a term used for animals without backbones, e.g. insects, spiders, scorpions, worms and snails. Some invertebrates thrive anywhere, while others are 'specialists' occurring in limited habitats or depending on a single plant species for their survival. Invertebrates are the backbones of biodiversity, representing the majority of the world's animal species. They are also the little creatures that run the world, playing critical roles in the functioning of the ecosystem.

Monitoring reveals species of conservation value and triggers management strategy, it informs measures of landscape stability, ecosystem function and biodiversity. Going forward invertebrates monitoring will focus on historically active but now dormant areas to see how the natural environment has re-established itself over longer periods.

Desired Outcome 8.1.	**The ecological integrity of the Central Namib is maintained.**
Target 8.1.1.	**The mining industry and associated service providers avoid impacts to biodiversity and ecosystems, and where impacts are unavoidable, minimisation, mitigation and/or restoration and offsetting of impacts is achieved.**
Indicator 8.1.1.1.	**Important biodiversity areas [red or yellow flag areas] are taken into consideration when adjudicating prospecting and mining applications.**
Data Source	**NERMU/NUA/MET**
Status:	**NOT MET**

The SEA envisaged that important biodiversity areas would be red-flagged or yellow-flagged in the National Policy on Prospecting and Mining in Protected Areas, meaning that mining or prospecting activities would not be permitted in these areas (Figure 44). Table 31 indicates in which areas mining and prospecting will be prohibited once the policy has been approved. No-mining areas include the Ugab River, the entire coastline between Ugab and Sandwich Harbour with some hotspots further inland (Figure 42), the Kuiseb River and delta, the lichen fields east of Wlotzkasbaken and three small sites along the C28 and C14 roads (Figure 43). The policy will not give "specially protected" status to the Welwitschia plains, the Omaruru, Swakop and Khan rivers, and numerous larger and smaller biodiversity hotspots within the northern Namib Naukluft National Park.

Table 31: Protection Status of Red-flagged Central Namib Biodiversity Hotspots

EQO 8 Biodiversity Area	Protected Area Name	Policy prohibits mining?
Brandberg	Tsiseb Conservancy	**Yes***
Messum Crater	Dorob, Tsiseb Conservancy	No
Ugab River	Dorob NP and Tsiseb	**Yes**
Coastal area between Ugab River and Sandwich Harbour	Namib Naukluft and Dorob National Parks	**Yes**
Omaruru River	Dorob National Park	No
Spitzkoppe (Gross and Klein)	#Gaingu Conservancy	Partly*
Wlotzkasbaken lichen fields	Dorob National Park	**Yes**
Swakop/Khan River	Namib Naukluft NP	No
Welwitschia Plains	Namib Naukluft NP	No
Langer Heinrich Mountain	Namib Naukluft NP	No
Several spots in Northern NNNP	Namib Naukluft NP	No
Kuiseb River and Delta	Namib Naukluft, Dorob	**Yes**

*Protected as national monuments

The policy is not yet in place, but the final draft clearly shows that many important biodiversity areas proposed in the SEA have not been identified as "no-mining" areas. MET:DEA reported that the Minister may have the power to refuse environmental clearance for mining projects in red and yellow-flagged areas. Whether this protection will be upheld in a court of law will only become apparent once new EPLs and MLs are issued.

Motivation of status: Many of the red and yellow-flagged biodiversity areas listed in the indicator have been excluded from the final draft of the prospecting and mining in protected areas policy. It is not clear if areas outside of national parks can be protected by means of refusing environmental clearance. The indicator was therefore regarded as **NOT MET**.

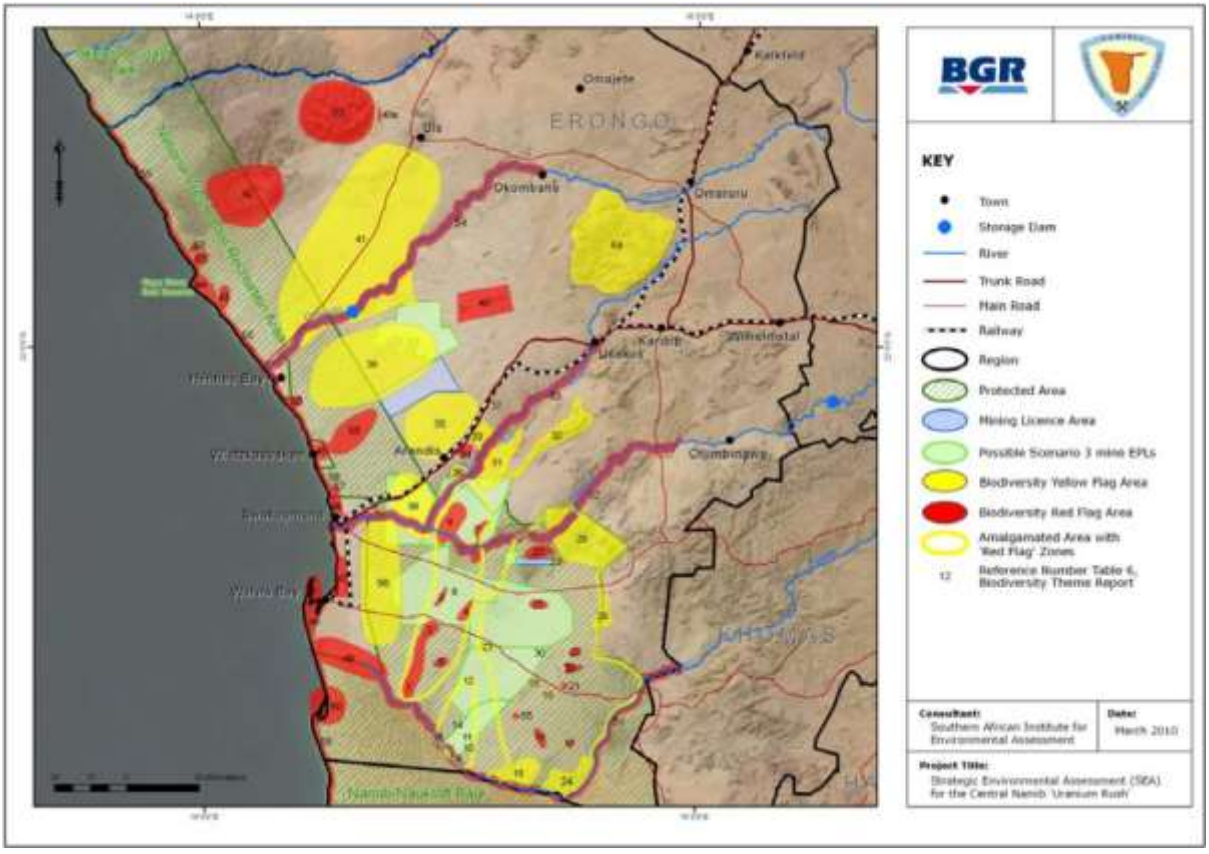


Figure 44: Red and Yellow Flag Biodiversity Areas

Indicator 8.1.1.2.	**The EIAs need to follow the mitigation hierarchy and incorporate offsets as an option.**			
Data Source	**NERMU/NUA/MET**			
Status:			**MET**	

The EIA amendment process for Swakop Uranium's infrastructure mentioned under Indicator 7.2.1.3 followed this approach. The requirement to include offsets will be determined during the biodiversity specialist's study, which was still in progress at the time of writing.

Motivation of status: Swakop Uranium's EIA amendments were the only studies carried out in 2017. The indicator was **MET**.

Indicator 8.1.1.3.	**GRN keeps a record of all decisions made regarding prospecting and mining applications so that applications denied on biodiversity grounds are not awarded in the future, unless alternative approaches are adopted to avoid impact, mitigate or offset the impact.**
Data Source	**NERMU/NUA/MET**
Status:	**MET**

The Mining Directorate of the Ministry of Mines and Energy confirmed that records of decision are kept when licences are considered. The grounds for rejection are recorded in the minutes of Mining Advisory Council meetings. MME issued only one new mining licence in 2017. In this case the company concerned had a mining licence for dimension stone, which was amended to include nuclear fuels. As far as could be established, the project area had not been subject to previous EPL or ML applications that were denied on biodiversity grounds.

Motivation of status: Considering the wording of the indicator, it should be rated as **MET**, though the usual application procedures for a mining licence, e.g. conducting an EIA and feasibility study, have not been followed.

Indicator 8.1.1.4.	**Mines have specific programmes and projects to actively avoid, mitigate, restore or offset their impacts, with impact avoidance predominating.**
Data Source	**NERMU/NUA**
Status:	**MET**

Operational mines indicated that avoidance is the preferred solution, but it is not always possible because large areas have to be disturbed to access and process the ore. Mining companies have specific programmes to actively avoid, mitigate, restore their impacts and these are documented in their EIAs, EMPs and company-internal policies.[83]

Langer Heinrich Uranium has a comprehensive biodiversity action plan that encompasses a detailed set of objectives, schedules, responsibilities, and deliverables for all different phases of the mine (from exploration through to closure). To manage water as an ecological driver the company monitors surface and ground water levels and quality. Langer Heinrich has an active plant nursery on site where tests are carried out to determine the viability of transplanting of indigenous species and to investigate other issues of interest.

Rössing Uranium reported that compliance with the Rio Tinto land disturbance control and rehabilitation standard is mandatory. The standard prescribes the implementation of a land use management plan, which provides an overall land management direction, including biodiversity management. Concepts such as avoidance, mitigation and rehabilitation are well embedded in Rössing Uranium's land use decisions.

[83] NUA (2018): Input to 2017 Annual SEMP Report

Swakop Uranium finalised the biodiversity and land use procedure in 2017. The Swakop Uranium biodiversity and land use procedure incorporates the following aspects in managing the abovementioned risks related to land use management:

- Identification and communication of No-go areas (i.e. biodiversity or archaeological sites)
- The Environmental Section requires a Land Clearance & Disturbance Application Form to be completed before entering and/or disturbing any previously undisturbed areas. Pre-disturbance inspections identify important fauna, flora and/or archaeological artefacts. Information gathered determines whether activity may proceed or not
- Reuse/reassign disturbed areas rather than disturbing new land
- Monitor natural stormwater catchments and drainage systems
- Stockpile topsoil for rehabilitation and restoration activities in future

The company is developing a comprehensive Biodiversity Action Plan that will encompass a detailed set of objectives, schedules, responsibilities, and deliverables for the life of the mine. To manage water as an ecological driver Swakop Uranium monitors surface and ground water levels and quality, and monitors the health and vigour of riparian vegetation in the Swakop and Khan rivers and around the mine. Swakop Uranium has mapped the distribution of *Welwitschia mirabilis* within its mining licence and EPL areas and studied its biology in cooperation with conservation partners. All operating companies' internal environmental monitoring and rehabilitation initiatives continued in 2017 as part of their EMP and ISO 14001 compliance requirements.

Motivation of status: EIAs and EMPs of operational mines comply with the mitigation hierarchy as stipulated in the SEMP and MET's ECC application assessment process, the indicator was **MET**.

Indicator 8.1.1.5.	**Sensitive areas are identified by mines and disturbance of these areas is minimized.**			
Data Source	**NERMU/NUA**			
Status:			**MET**	

All active mines have mapped sensitive areas within their mining licence areas and have programmes in place to minimize the size of their footprint on sensitive biodiversity. For instance, Reptile Mineral Resources and Exploration have identified a stand of *Welwitschia mirabilis* plants at the INCA prospect and are monitoring their condition (see case study below). Because mining companies cannot always avoid causing disturbances they make provision for the rehabilitation of disturbed areas (see EQO 12).

At Langer Heinrich Mine security personnel are stationed at the remote (main) entrance points to manage access to the mine. Continuous environmental awareness training took place during 2017 and covered topics such as the NNNP permit, park rules and conditions, and the avoidance of secondary impacts on sensitive biodiversity areas.

Swakop Uranium has fenced off the mine site to keep mining activities and employees within the allowed area of disturbance. Security personnel are stationed at the main entrance points to manage access to the mine and the NNNP. Only the departments that work in exploration camps, linear infrastructure and monitoring sites are allowed into the park. The Environmental Section inspects the various off-site areas, investigates any unusual findings and reports them to the NNNP Warden and his team. In addition, sensitive areas are usually identified during the EIA process. Daily information obtained from site inspections, vegetation surveys after rainfall events, fauna observations,

etc. add on to the information obtained during the EIA process. This information is used to identify previously excluded topics, e.g. a *Lithops* survey.

Motivation of status: The indicator was **MET** as all mines reported that they have mapped out sensitive habitats within their mining licence areas. Possible impacts are continuously monitored, assessed and mitigated according to the mitigation hierarchy.

Case Study – *Welwitschia mirabilis* Survey at the INCA Prospect

Reptile Mineral Resources and Exploration have been monitoring *Welwitschia mirabilis* at the INCA prospect since 2009. The 10 monitored specimens have grown by approximately one metre in nine years at an average rate of 12 cm per year. The growth rate seems to depend on the availability of water. The photos below show how the leaves of Welwitschia plant no. 5 were damaged by springbok in February 2012, but had regrown to a length of 42 cm in May 2018.

February 2012 **May 2018 (Photos by RMRö)**

Plant	W01	W02	W03	W04	W05	W06	W07	W08	W09	W10	Average
Growth 2009-2018 (m)	0.66	1.47	0.80	1.05	1.03	1.29	0.82	1.40	0.92	1.10	**1.05**
Average per year (m)	0.07	0.16	0.09	0.12	0.11	0.14	0.09	0.16	0.10	0.12	**0.12**

Indicator 8.1.1.6.	**Infrastructure corridors are carefully planned to avoid ecologically sensitive areas, and demonstrate:** - **consideration of alternatives,** - **optimization of service provision; and** - **commitment to the 'green route'**
Data Source	**NERMU/NUA**
Status:	

Indicator 8.1.1.7.	**Mines share infrastructure as much as possible, thus minimizing infrastructure proliferation.**
Data Source	**NERMU/NUA**
Status:	

Indicator 8.1.1.8.	**Infrastructure planning and investment takes into account future demand, thus reducing the need for additional impacts.**
Data Source	**NERMU/NUA**
Status:	

There were no new large infrastructure projects in 2017 that could have resulted in the establishment of infrastructure corridors.

Motivation of status: The three indicators related to the development of infrastructure corridors were **NOT APPLICABLE**.

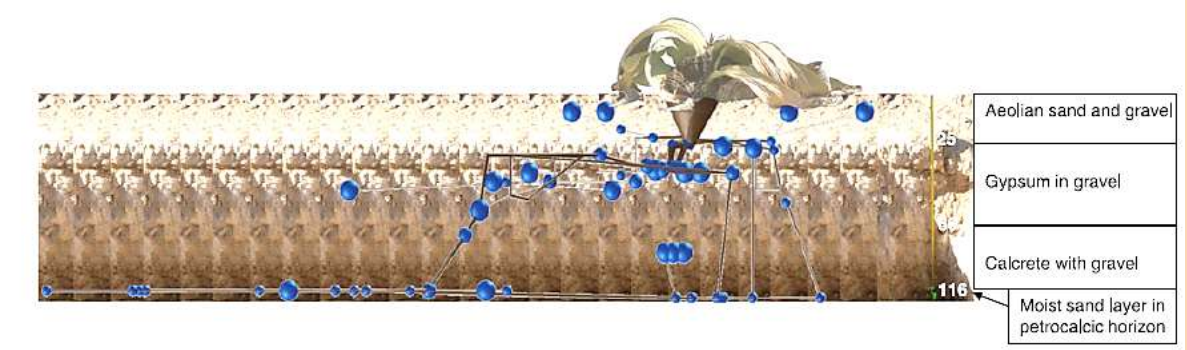
Desired Outcome 8.2.	**Mining industry becomes a conservation partner.**
Target 8.2.1.	**Mines and associated industries support conservation efforts in Namibia.**
Indicator 8.2.1.1.	**Mining companies (particularly those operating in the NNP) partner with conservation organisations to effectively manage their biodiversity impacts (both direct and indirect).**
Data Source	**NERMU/NUA/MET**
Status:	**MET**

Swakop Uranium appointed Gobabeb/NERMU to develop a five-year ecological monitoring and research programme that addresses EMP commitments regarding species of concern (i.e. Hartmann's zebra, welwitschias, gerbils, riverine vegetation, Husab sand lizard). While data collection for the project on riparian vegetation in the Ida Dome compartment of the Swakop River and in the Khan River is still underway, the case study below highlights the results of a pioneering botanical study that started at the inception of the Husab project and has now been published.[84]

[84] Henschel, J. R. et al. (2018): Roots point to water sources of Welwitschia mirabilis in a hyperarid desert. Ecohydrology 2018, wileyonlinelibrary.com/journal/eco, https://doi.org/10.1002/eco.2039

Case Study – *Welwitschia mirabilis* Research at Swakop Uranium

Welwitschia mirabilis is a long-lived evergreen that grows in the hyperarid Namib Desert where rainfall is rare (31 mm mean annual precipitation), groundwater deep (57-75 m), and fog frequent (50–90 events per year). By examining root architecture in relation to soil moisture and analysing the isotopic composition of hydrogen and oxygen of plant and soil water, a study established whether welwitschia sources water from a stable supply of deep groundwater, or from shallow moisture originating from fog and dew, or from rainwater at infiltration depth. Isotopes suggested rainwater as principal water source.



Welwitschia Root Structure (Lines) and Location of Fine Roots (Blue Spheres) (Figure by J Henschel)

Most (55%) major roots and fine roots occurred in 10-66 cm deep layers of gypsum containing 10% moisture. A further 25% of both root types grew in moist sand in petrocalcic horizons at depths of 93-125-cm. A high density of fine roots (14% of total) grew upwards towards the ground surface in a 1.5 m radius around plants, an area occasionally wetted by run-off of fog and dew.

It was concluded that welwitschia mainly relies on rainwater obtained in perched horizons. Supplemental water is obtained from fog and dew from the surface and potentially from gypsum blocks. Multiple strategies enable this extremely long-lived evergreen to be resilient against dehydration in hyperarid conditions.

Langer Heinrich Mine also partnered with Gobabeb's GTRIP programme on restoration ecology (see case study under Indicator 8.2.1.3). Rössing Uranium and Swakop Uranium are working with the NamPower/NNF Strategic Partnership to monitor the impact of power line corridors on birds such as Ludwig's bustards, korhaans, raptors and flamingos. Swakop Uranium conducted monthly inspections on both internal and NamPower overhead power lines. Mitigation measures to reduce bird collisions have been installed where the power line to Husab mine crosses the Khan River. Two camera traps mounted on power line poles in the river monitor the presence of larger birds. These cameras are monitored and maintained by Swakop Uranium.

Motivation of status: In 2017, mining companies partnered with conservation organisations as far as possible, considering the limitations imposed by the low uranium price. The partnerships with Gobabeb, NERMU and the NamPower/NNF Strategic project have been running for many years and have started delivering valuable results. The indicator was therefore **MET**.

Indicator 8.2.1.2.	**Mining companies commit to sustainable offset initiatives to ensure 'no net loss' to biodiversity as a result of their operations. This will involve partnering with long-term conservation partners (GRN, NGOs and communities).**
Data Source	**NERMU/NUA/MET**
Status:	**NOT MET**

Multinational mining companies such as Rio Tinto have in recent years reconsidered their commitment to "no net loss", mostly due to difficulties experienced in the implementation of offsets and the downturn in global commodity markets.[85] Companies indicated they would still consider biodiversity offsets if rare biodiversity was lost and restoration was not possible (Figure 45).

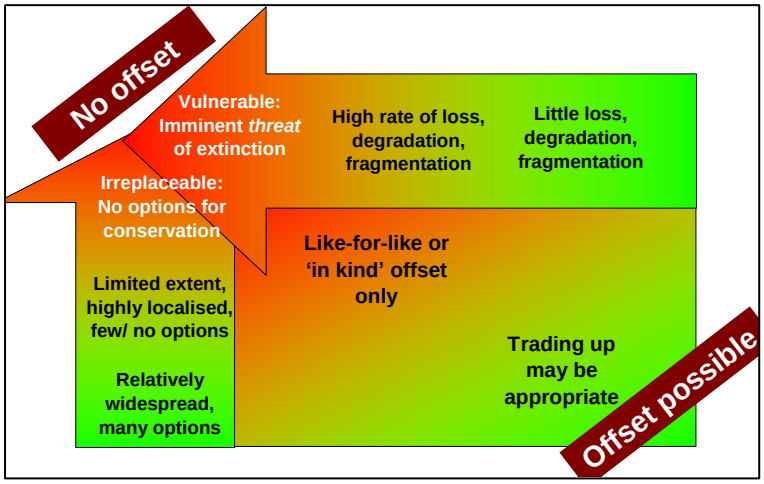


Figure 45: Conditions for Offsets (Diagram by BBOP)

In Namibia, there is an additional obstacle to the implementation of a 'no net loss' policy. The country does not have a legal framework for the establishment and protection of offsets as defined by Flora and Fauna International (FFI) and the Business & Biodiversity Offsets Programme (BBOP). Given the fact that mining is permitted in protected areas, it would not make sense to spend money on biodiversity offsets in areas that may be disturbed by mining or other development in future.

The most important prerequisite for offsets is legislation that will enforce the protection of identified conservation or offset areas, even if there are mineral resources underground. This information has been shared with MET's NBSAP2 steering committee, since biodiversity offsets are included as a target in the second National Biodiversity Strategy and Action Plan (NBSAP2). The mining industry, MME and NERMU are represented on the steering committee and discussing the possible inclusion of biodiversity offsets in the revision of the Environmental Management Act with MET.

Motivation of status: The main factor contributed to this indicator being classified as **NOT MET** was the lack of a regulatory framework for the implementation of offsets.

[85] Pers. comm. NUA 2017

Indicator 8.2.1.3.	**Additional conservation projects are supported (e.g. wetland bird counts, wildlife surveys, Namib Bird Route, coastal management, research, public awareness) as part of the companies' social responsibility programmes.**			
Data Source	**NERMU/NUA/MET**			
Status:			**MET**	

Langer Heinrich Uranium continued its cooperation with the Desert Research Foundation of Namibia's in-service training programme for graduates. The company contributed N$250,000 to the Gobabeb Research and Training Internship Programme (GTRIP), which supports the development of scientific research skills of young environmental professionals through a five-month field-based internship programme facilitated at the Gobabeb Research and Training Centre with practical work being carried out at the mine (see case study below).

Case Study – Testing the Soil at Langer Heinrich Mine

Langer Heinrich Uranium removes topsoil and subsoil before mining takes place and stores it until the uranium deposit has been mined out. The soil is then used to rehabilitate the disturbed areas. There have been conflicting reports about the viability of the soil after years of storage, i.e. its ability to support plant growth.

Halleluya Shaanika Monitoring Plant Growth at the Nursery (Photo by GTRIP)

A GTRIP student investigated the fertility of soil stored on the mine by planting seeds in different soil types. He found that the germination success was marginally better in topsoil than in subsoil, but the growth rate was better in subsoil. Mr Shaanika recommended a mixture of soil types, as well as natural and artificial fertilizers for use in rehabilitation. The project has great significance to the mine, as the knowledge gained can help with the detailed planning of restoration measures to be implemented during mine closure.

Rössing Uranium has been hosting annual BirdWatch events since 2000. This is considered a valuable additional conservation action and a means to engage stakeholders as each year some 70-100 school children participate in the event.

Swakop Uranium is committed to ongoing contribution to the knowledge and conservation of biodiversity in the NNNP, e.g. by contributing resources toward key species-related biodiversity studies such as *Welwitschia mirabilis* (see case study under Indicator 8.2.1.1). The Swakop Uranium Foundation partnered with NACOMA for a clean-up campaign in Swakopmund in the last quarter of 2017; areas around the B2 road were identified for a clean-up initiative carried out by members of the community. The Swakop Uranium Foundation also partnered with the Tsiseb conservancy in their effort to manage and monitor the wildlife within their area in the Daures constituency, as well as their anti-poaching activities. Equipment which includes binoculars, tents, GPS trackers and other items was purchased for the conservancy. The Foundation also made a donation to the Ministry of Environment and Tourism to assist the police and conservancies in their wildlife preservation and anti-poaching activities.

Bannerman Mining Resources continued its partnership with TOSCO (Tourism Supporting Conservation) and supported the joint venture between the Tsiseb Conservancy (Erongo Region) and the Brandberg White Lady Lodge with funds to train young people of the conservancy. They also maintained 'no off-road driving' signs in parts of the Namib Naukluft Park.

Motivation of status: The indicator was **MET** by supporting various additional conservation projects**.**

Indicator 8.2.1.4.	**Protection and management of key biodiversity offset areas is supported (e.g. NW Kunene, Messum, Spitzkoppe, Brandberg and other special areas in Namibia).**
Data Source	**NERMU/NUA/MET**
Status:	

This indicator cannot be evaluated until Government has provided a legal framework for the protection and management of biodiversity offset areas. It also still needs to be decided whether the areas listed above will emerge as suitable key biodiversity offset areas.

Motivation of status: The indicator was **NOT APPLICABLE**.

Desired Outcome 8.3.	**No species become extinct because of uranium mining.**
Target 8.3.1.	**Authorisation to mine is denied if the extinction of a species is likely.**
Indicator 8.3.1.1.	**All EIAs and EMPs must consider national extinction possibility.**
Data Source	**NERMU/NUA/MET**
Status:	

See feedback under Indicator 8.3.1.2.

Indicator 8.3.1.2.	**Resources for a reasonable investigation are made available to manage species at risk of extinction**
Data Source	**NERMU/NUA/MET**
Status:	

There were no new EIAs for projects that could affect species extinction conducted during the review period and thus no assessment of these two indicators could be made.

Motivation of status: The indicators were **NOT APPLICABLE**.

Desired Outcome 8.4.	**No secondary impacts occur**
Target 8.4.1.	**No secondary impacts occur**
Indicator 8.4.1.1.	**Off-road driving, poaching, illegal camping, littering by mine personnel, are explicitly prevented by mining and exploration personnel and their contractors.**
Data Source	**NERMU/NUA/MET**
Status:	**IN PROGRESS**

Mining and exploration continued their efforts to prevent secondary impacts in 2017. Companies operating in the park applied the following measures to educate and control their personnel and contractors. Bannerman Mining Resources have demarcated the roads leading to their Demonstration Plant and provided turn-around points every 400 metres to restrict the environmental footprint and prevent illegal off-road driving. Contractors and employees are inducted in the rules of the National Park and no night work is allowed. The company has continued to grade a section of the park road along the Moon Landscape towards the Big Welwitschia.

Langer Heinrich Uranium and Swakop Uranium distribute the park rules to all employees, contractors and visitors. All employees, visitors, contractors, suppliers and service providers are inducted in the park rules. The induction includes topics such as correct waste management practices, driving behaviour (including speed limits) and protection of local fauna and flora. Stringent access control measures are in place with daily security checks being carried out. Off-road driving is prohibited and only existing roads are used.

Reptile Mineral Resources and Exploration enforces stringent rules and controls of their exploration activities in the NNNP. All employees and visitors receive inductions in the NNNP rules before they are allowed to start any kind of exploration activities. Off-road driving is prohibited and only existing roads are used. Drill sites and tracks are marked beforehand to prevent – as much as possible - disturbance to plants, nesting birds, known archaeological sites, and areas that are difficult areas to rehabilitate (like gypsum crusts). Company staff report vehicle and motorcycle tracks found (and not made by the company) and other extraordinary disturbance, e.g. animals killed, to the NNNP warden.

Motivation of status: The indicator requires that secondary impacts by mine personnel and contractors are prevented. Companies operating within the national park confirmed that they were doing everything possible to avoid secondary impacts. Incidents observed by the Ministry of Environment and Tourism could have been caused by persons not employed in the mining industry, but this could only be confirmed if the Ministry kept records of offenders' place of work. The indicator was regarded as **IN PROGRESS.**

Indicator 8.4.1.2.	**Improved vigilance and visibility of law enforcement personnel, with structured support from civil society (e.g. Honorary Wardens) reduces park/conservation transgressions.**
Data Source	**NERMU/NUA/MET**
Status:	**MET**

The Ministry of Environment and Tourism reported that there has been improved vigilance and visibility of law enforcement with support from the mines and members of the public. However, the Ministry of Environment and Tourism could not provide data to assess the extent to which the situation has improved. The matter of honorary wardens was resolved at a MET workshop in February 2018 when it was pointed out that the Protected Areas and Wildlife Management Bill makes provision for the appointment of honorary conservation officers: [86]

144 (1) The Minister may in writing delegate any power conferred upon him or her by or under this Act, except the powers to make regulations and to hear reviews, to any officer in the Ministry or to any officer of the Ministry or any honorary conservation officer or a conservancy member.

Motivation of status: The indicator was **MET** because the Ministry of Environment and Tourism and mines in the NNNP have improved their vigilance and the Protected Areas and Wildlife Management Bill makes provision for the appointment of honorary conservation officers.

Desired Outcome 8.5.	**Water quality and quantity does not decrease to the extent that it negatively affects biodiversity.**
Target 8.5.1.	**Water table levels, and water quality standards are described and ephemeral river ecosystems are monitored to ensure that these standards are not compromised.**
Indicator 8.5.1.1.	**Regular monitoring of indicator species in relevant ephemeral rivers is in place to detect any impacts on wetlands, phreatophytes and riparian vegetation.**
Data Source	**NERMU/NUA/MET**
Status:	**MET**

[86] MET: Protected Areas and Wildlife Management Bill, 31 August 2017

Swakop Uranium has appointed Gobabeb/NERMU to develop a long-term ecological monitoring and research programme for Husab mine, which includes developing a monitoring programme on riverine tree health. Regular field campaigns were carried out in 2017, though no abstraction took place. Photosynthetic efficiency, water potential and growth measurements are part of the ongoing data collection and interpretation. The purpose of developing the monitoring programme is to identify tree health indicators (i.e. water stress, etc.) and collect data over a five-year period covering uncompromised and compromised conditions. The general objective of the study is to understand if and how abstraction of groundwater affects tree mortality, how this effect presents itself and how the trees may be monitored effectively to timeously detect and prevent damage to the riparian forests.[87] The information obtained will be used to assist management in decision-making. Riparian vegetation monitoring is a long-term project that does not lend itself to the publication of interim results. For the purpose of this indicator the five-year study can be regarded as "regular monitoring".

Rössing Uranium has been monitoring trees at selected transects along the Khan River for close to 30 years and developed guidelines for groundwater extraction that will protect the vegetation. The biannual surveys in 2017 did not detect any unusual deterioration in the condition of the riparian flora. The water table was fairly stable because the production boreholes were not used in 2014-2015 and pumping rates in 2016-2017 were much lower than the permitted quota.

Motivation of status: The indicator was rated **MET** because surveys were conducted in 2017 to define the impact of water abstraction on the riverine vegetation in the Khan and Swakop rivers.

Indicator 8.5.1.2.	**Results from monitoring are fed back to regulators and impacting companies so that negative impacts on riverine vegetation, springs and pans can be dealt with appropriately.**			
Data Source	**NERMU/NUA/MET**			
Status:			**MET**	

As mentioned under Indicator 8.5.1.1, monitoring programmes are in place to determine the effects of groundwater abstraction on the riverine vegetation. Rössing Uranium reports the results for the Khan River to DWAF. NERMU gives progress reports to Swakop Uranium who communicate the information to DWAF in their regular reports.

Feedback to regulators for the purpose of impact prevention is also taking place in form of groundwater level monitoring by mines that have an abstraction permit and DWAF as reported in EQO 4, indicator 4.2.1.2 "Borehole levels fluctuate within existing norms". MWAF's groundwater abstraction permits require that permit holders submit monthly abstraction return reports (abstraction volumes, RWL, rainfall, etc.) to DWAF. The mining companies complied with this permit condition.

Motivation of status: This indicator was regarded as **MET** because regulators received feedback in 2017 and water level monitoring for Indicator 4.2.1.2 did not reveal any abnormal changes; remedial action was therefore not required.

[87] Pers. comm. NERMU 2017

Target 8.5.2.	**Uranium mining does not compromise surface and groundwater availability.**			
Indicator 8.5.2.1.	**No unusual loss of wetland and riparian vegetation.**			
Data Source	**NERMU/NUA/MET**			
Status:		**IN PROGRESS**		

Indicator 8.5.2.2.	**No unusual loss of phreatophytes (deep-rooted plants dependent on water from the saturated zone of groundwater).**			
Data Source	**NERMU/NUA/MET**			
Status:		**IN PROGRESS**		

These two indicators follow on from the monitoring programmes mentioned under 8.5.1.1. As reported there NERMU has appointed a researcher who is working on a series of papers about the occurrence and vitality of large trees in the Swakop and Khan rivers. Significant progress has been made in 2017. The camelthorn (*Acacia erioloba*) is the most important phreatophyte (deep-rooted plant) in the ephemeral rivers and is therefore a good indicator of whether deep-rooted plants are affected by groundwater pumping. The baseline study conducted by NERMU did not show a clear link between tree stress and abstraction of water.[88] The groundwater levels in 2017 as shown in EQO 4 were well within the documented rooting depths of the camelthorn, which can reach more than 50 metres.[89] The results of the ongoing study will hopefully show if there has been any unusual loss of wetland and riparian vegetation and identify the contributing factors.

Motivation of status: Seeing that results are expected in the near future the indicators were rated **IN PROGRESS**.

[88] Wassenaar T., T. Shuuya & H. Mbura (2013): Baseline for the Development of a Central Namib River Vegetation Monitoring Programme for the SEMP, Attachment to 2013 SEMP Report

[89] Schachtschneider, K. (2010) Water sourcing by riparian trees along ephemeral riverbeds. Unpublished PhD thesis, University of Cape Town

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Summary of performance: EQO 8

Total no. indicators assessed: 14 (6 were **NOT APPLICABLE**)

	NOT MET	IN PROGRESS	MET	EXCEEDED
Number of indicators in class	2	3	9	0
Percent of indicators in class	14%	21%	64%	0%

Overall performance: Nine of the Ecological Integrity (EQO 8) indicators were **MET** in 2017 (64%). It was confirmed that mines use the mitigation hierarchy to actively avoid, mitigate or restore the affected environment, specifically sensitive areas within the mining licence areas. Mining companies have also partnered with conservation organisations and supported additional conservation projects, as far as currently possible. The Ministry of Environment and Tourism has improved its visibility in the parks with the support of concerned stakeholders and the impact of mines on the ephemeral rivers was monitored.

Three indicators related to secondary impacts in protected areas and studies being conducted to understand the impact of water abstraction on the riverine vegetation and to develop a regular monitoring programme for riverine vegetation and wetlands are still **IN PROGRESS** (21%). The two indicators concerning the protection of important biodiversity areas and the implementation of biodiversity offsets were **NOT MET** (14%) due to the absence of enabling legislation. Six indicators were **NOT APPLICABLE** because the relevant activities did not take place in 2017.

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EQO 9. Education

Aims of this EQO: In the Erongo Learning Region, people continue to have affordable and improved access to basic, secondary and tertiary education, which enables them to develop and improve skills and take advantage of economic opportunities.

The education EQO keeps track of the evolution of the education sector in the Erongo Region to ensure that school leavers will be well placed to find employment in the industry, either immediately after finishing school or when they have obtained a tertiary qualification. The Ministry of Education (MEAC) has introduced free primary education in 2013 and decided to provide free secondary education in 2016. This will address the aim of "affordable access" to education, but may influence the "improved" performance of the schools, depending on whether the government will be able to provide sufficient resources to sustain the quality of free education.

While much of the information for EQO 9 is kept by the Ministry of Education, the mining industry contributed the indicators related to bursaries and skills development programmes for employees. In addition to this, many companies support education as part of their social responsibility programmes. There is no SEMP indicator for this topic, but it is worth mentioning in this report. The Namibian Uranium Association invested funds, resources and technical skills in organising and hosting a career fair that was visited by more than 1,000 secondary learners in the Erongo Region.

Rössing Uranium finances and implements numerous education initiatives through the Rössing Foundation. Project Safety W.I.S.E., which is a three-year safety awareness initiative, was implemented in partnership between AREVA Resources Namibia, Rössing Uranium and the Directorate of Education, Arts and Culture of the Erongo Regional Council (Figure 46). The initiative supports the creation of a culture of safety among primary education learners in Arandis, Swakopmund and Walvis Bay. The initiative is built on the belief that if learners are exposed to safety awareness throughout their education, safety consciousness will become an integral part of their lives. The Rössing Foundation implements countrywide educational support programmes.

Figure 46: Project Safety W.I.S.E.

Langer Heinrich Uranium (LHU) provided additional support to education through donations and sponsorships payments to the value of N$2,340,200. This amount excludes contributions made towards the intake of NIMT students, the graduate development programme, staff development and contributions towards the VET Levy. The Mondesa Youth Opportunities Trust continued to receive financial support (N$1.3 million) and equipment for the centre's computer laboratory. LHU supported the Annual National Mathematics Congress, which helped to develop the mathematics teaching skills of more than 300 teachers from all 14 regions of Namibia. Funds also went to the seventh year of the Mathematics Enrichment Programme that provides weekly tutoring sessions to gifted learners in higher or extended level mathematics. Other activities included mathematics spring schools, regional mathematics competitions and teacher mathematics workshops.

Langer Heinrich Uranium contributed towards various performance recognition initiatives of local primary and secondary schools, the University of Science and Technology, as well as the Regional Teachers Awards hosted by the Regional Directorate of Education, Arts and Culture. The mine also donated computers to Men-on-the-Side-of-the Road, an NGO which provides skills development to unemployed and low-skilled Namibians. In addition, computer equipment was donated to a primary school near Outjo and a pre-primary school in Swakopmund. Materials such as wooden pallets, iron and stainless steel were given to NIMT for use in their workshops during practical training sessions. Approximately 160 girls and boys from schools in low-income areas benefitted from a donation towards the promotion of youth sports codes such as soccer, handball, netball and cricket. Young Namibian athletes gained from national and international exposure during various competitions, and schools' sports administration and coaching were also strengthened. Lastly, a donation to the Promiseland Trust Feeding Scheme assisted in providing daily meals to approximately 200 disadvantaged children at various schools in Walvis Bay.

The Swakop Uranium Foundation partnered with the Erongo Directorate of Education to sponsor the spring school for Grade 10 and 12 students in August 2017. This partnership has been in place for the last four years. The initiative assists students to have extra lessons to ensure that they pass the year end examinations. The Foundation also donated two prefabricated containers to be used as classrooms to the Monica Geingos School and provided some computers and laptops. The Foundation sponsored the Erongo Youth Forum's Careers Fair for Grade 10 and 12 students in Omaruru and donated IT equipment to the Faith Academy in Walvis Bay.

Among the exploration companies, Bannerman Mining Resources continued its programme of donating school uniforms to primary schools in the Erongo Region. This programme has benefited over 2000 needy primary school children to date. BMR assists the Erongo Development Foundation to provide opportunities for under-privileged school leavers who want to obtain a trade certificate. In 2017 five students were supported at the Namibian Institute of Mining and Technology (NIMT), while another student went to the College of Cape Town to study towards a mechanical engineering diploma.

Reptile Mineral Resources and Exploration continued supporting the Hanganeni primary school in Mondesa with donations of text books and stationery. They also entered into a partnership with Bannerman Mining Resources to upgrade the Topnaar Utuseb early childhood centre with water supply, paving and provision of shade-netting for the playground.

Zhonghe Resources Namibia has signed an agreement with the Namibia Students' Financial Assistance Fund (NSFAF) to assist Namibian students who want to study civil engineering in China. The total investment in these scholarships is N$1 million for 50 students.

Desired Outcome 9.1.	**Improved quality of school education.**
Target 9.1.1.	**Improved results.**
Indicator 9.1.1.1.	**Erongo Region Grade 10 and 12 results improve over time compared to other regions.**
Data Source	**MEAC**
Status:	**NOT MET**

Information in the Ministry of Education, Art and Culture's (MEAC) Education Information Management System (EMIS) showed that more than 56 300 Grade 12 candidates, 22 091 full-time and 34 214 part-time, attended the 2017 National Secondary School Certificate examinations at the ordinary level. Among the full-time candidates 39.3% (8632) qualified to enter institutions of higher learning. This outcome just missed the national target of 40% that the ministry had set for 2017. The target for 2016 was 45%. Ungraded results were recorded for 1400 full-timers and more than 6000 part-timers. The percentage of graded results among the part-time students was 81%, a slight increase from the previous year.[90]

Table 32: Ranking of Regions by Grade 12 Results 2014-2016

Region	2014	2015	2016	Region	2014	2015	2016
Oshikoto	1	1	1	**Erongo**	**8**	**7**	**8**
Oshana	2	2	2	Kunene	11	9	9
Omusati	3	3	3	Otjozondjupa	13	10	10
Ohangwena	4	4	4	Khomas	10	12	11
Kavango East	5	5	5	Omaheke	9	11	12
Zambezi	6	8	6	//Kharas	12	13	13
Kavango West	7	6	7	Hardap	14	14	14

MEAC reported the ranking of Namibia's 14 regions based on the Grade 12 results for 2014-2016 as shown in Table 32. Though the 2017 results were not provided it appears unlikely that the Erongo Region's placing in the middle of the field could have changed significantly.

Regarding the Grade 10 results MEAC reported that 53 332 pupils (40 599 full-time and 12 733 part-time candidates) attended the Junior Secondary Certificate examinations at the end of 2017.[91] The published data confirmed that 22 462 of 40 599 full-time learners passed the Grade 10 examinations, which required a minimum of 23 points and F in English, while 18 137 pupils failed to advance to Grade 11. The results were available on a regional basis (Figure 47), which indicated that the Erongo Region's pass rates, except for English second language, were among the lowest in the country. Erongo used to be one of the top regions, but has continuously deteriorated since then.

[90] MEAC: EMIS Education Statistics 2017
[91] Article "Few Places for Grade 10 Repeaters" in The Namibian of 21 December 2017

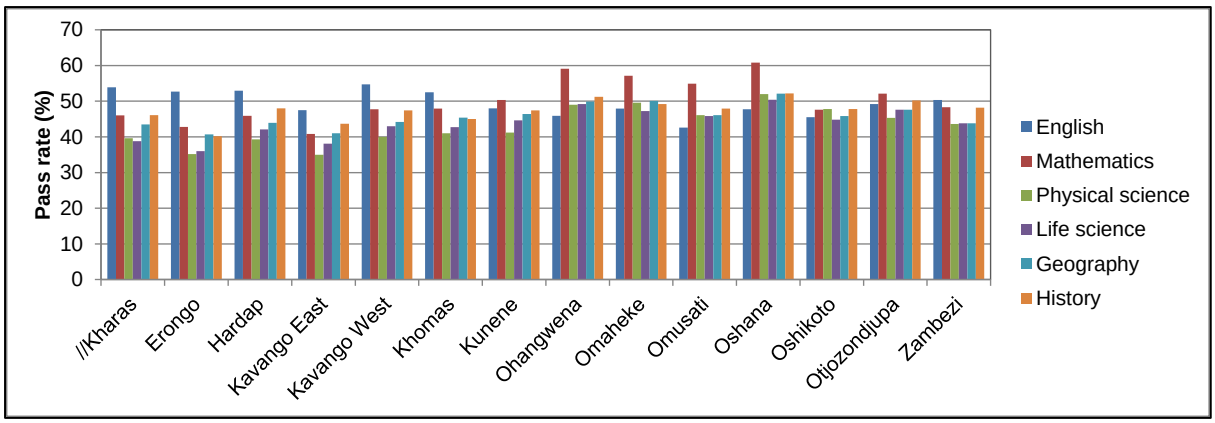

Figure 47: Grade 10 Examinations Results per Region in 2017

Motivation of status: This indicator was **NOT MET** because the Erongo Region's results did not improve compared to other regions.

Indicator 9.1.1.2.	**Teacher to learner ratio at GRN schools in Arandis, Swakopmund and Walvis Bay is better than the national average.**
Data Source	**MEAC**
Status:	**NOT MET**

Table 33 shows the teacher to learner ratios that were determined at the start of the 2017 school year at approximately 80% of all Namibian schools.[92] The ratio of 26 learners per teacher in the Erongo Region was slightly higher than the national average of 25 learners per teacher.

Table 33: Teacher to Learner Ratios per Region in 2017

Region	Learners	Teachers	Ratio	Region	Learners	Teachers	Ratio
//Kharas	22193	941	24	Ohangwena	102563	3982	26
Erongo	**42174**	**1600**	**26**	Omaheke	22466	884	25
Hardap	24392	984	25	Omusati	94672	4127	23
Kavango East	60869	1896	32	Oshana	53454	2277	23
Kavango West	41414	1464	28	Oshikoto	68987	2939	23
Khomas	87484	3702	24	Otjozondjupa	46430	1665	28
Kunene	29126	1058	28	Zambezi	37412	1648	23
Total					**733636**	**29167**	**25**

A comparison of the ratios from 2016 to 2018 shows no improvement in the Erongo Region (Figure 48). Separate figures for the schools at Arandis, Swakopmund and Walvis Bay were not readily available.

[92] Ministry of Education, Arts and Culture (2017): Fifteenth School Day Report for 2017 produced by the Education Management Information System (EMIS) division. Published on the UNICEF website www.unicef.org

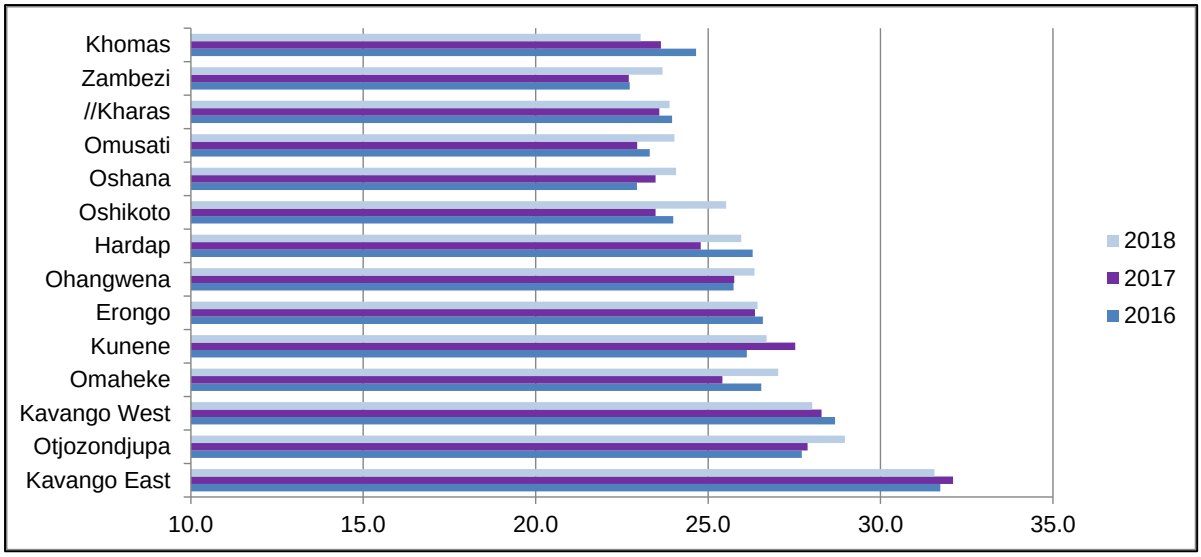

Figure 48: Teacher to Learner Ratios per Region 2016-2018

Motivation of status: The indicator was **NOT MET** because many other regions had lower teacher to learner ratios in 2017.

Indicator 9.1.1.3.	**National examination results in Grade 10 and 12 in maths, English and science are a D or better for more than 50% of learners from GRN schools.**
Data Source	**MEAC**
Status:	**NOT MET**

At the national level a D symbol or better in the JSC examinations was achieved by 35.3% of the learners in mathematics, 47.2% in English second language and 52.4% in physical science. Figure 47 under Indicator 9.1.1.1 shows that schools in the Erongo Region only exceeded the 50% target in English. The average pass rate for mathematics, English second language and physical science in Erongo was 43.6% compared to the national average of 48.4%.[93]

The 2017 NSSC national examination results for Grade 12 in ordinary level mathematics, science and English are presented in Figure 49. A D symbol or better was achieved by 41.3% of all learners in mathematics, 29.6% in English and 45.7% in physical science.[94] Though the Grade 12 results were not available per region, it can be inferred from the regional Grade 10 results that the Erongo Region's performance was probably not much different from the national Grade 12 outcome.

More than 16 300 out of 72 619 full and part-time candidates attempted the National Secondary School Certificate at the higher level, but these examination results were graded 1-4 and could not be compared to the ordinary level A-U symbols. They are therefore not included in the percentages evaluated here. MEAC reported that the national higher level results for 2017 scored slightly fewer graded results (94.4%) than in 2016 (95.5%).

[93] MEAC: EMIS Education Statistics 2017
[94] MEAC: EMIS Education Statistics 2017

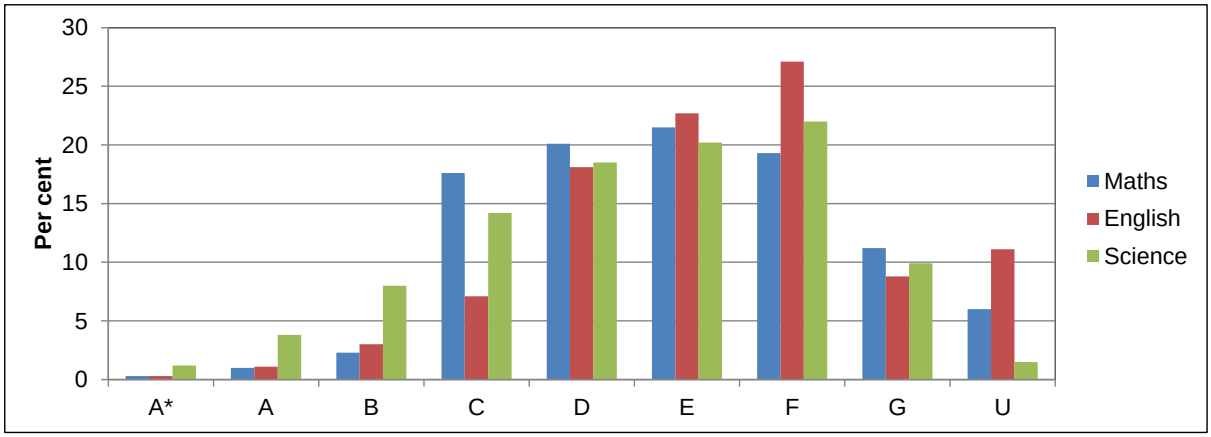

Figure 49: Grade 12 NSSC Ordinary Level Results in Relevant Subjects

Motivation of status: The indicator requires more than 50% of the learners to achieve at least a D symbol in English, physical science and mathematics in their NSSC examinations. None of the three results in 2017 was higher than 50%, so the indicator was **NOT MET**.

Indicator 9.1.1.4.	**Region improves performance in reading and mathematics.**
Data Source	**MEAC**
Status:	**NOT MET**

This indicator used to be assessed by means of the Namibian National Standardised Achievement Tests (NNSAT), which were administered to provide diagnostic information regarding learners' achievement of key competencies in the curriculum at Grades 5 and 7. The NNSAT was however suspended in 2016 to re-align it to the revised syllabi as a result of the national curriculum reform.[95] It appears that this process has not been completed in 2017, as there were no NNSAT results to be found on the ministry's website.

Based on the Grade 10 and Grade 12 results reported in Indicator 9.1.1.3, it appears unlikely that the Erongo Region has improved its performance in reading and mathematics. A comparison with previous SEMP reports rather points to a deteriorating performance over time.

Motivation of status: NNSAT results that were used to rate this indicator were suspended in 2016 due to the curriculum reform. Grade 10 and Grade 12 results in mathematics and English (as an indication for reading skills) were below the target of 50% D and higher in 2017. The indicator was therefore rated **NOT MET**.

[95] Article in The Namibian of 30 Oct 2016; http://thepatriot.com.na/index.php/2016/10/30/education-ministry-suspends-grade-5-and-7-standardised-tests/

Desired Outcome 9.2.	**Increased availability of technical skills in Erongo.**			
Target 9.2.1.	**More qualified artisans, technicians, geologists, accountants and engineers.**			
Indicator 9.2.1.1.	**Increasing number of graduates from NIMT, NUST and UNAM.**			
Data Source	**SEMP Office/UNAM/NUST/VTC/NIMT**			
Status:			**MET**	

Qualified artisans, technicians, geologists and engineers are needed in the uranium mining industry. Indicator 9.2.1.1 envisages that an increasing number of graduates from the institutions listed above will ensure that the necessary skills are available to the mining industry. Since 2011, UNAM and NUST have each produced around 2500-3000 graduates per annum with a slight increasing trend over time (Figure 50). At NIMT around 300-500 artisans complete their training every year. The mining industry contributed to vocational training by paying the VET levy in 2017 and by supporting a total of 150 apprentices at NIMT. Langer Heinrich subsidised 83 of these apprentices of which 81 were from NIMT and 2 were from the NTA.

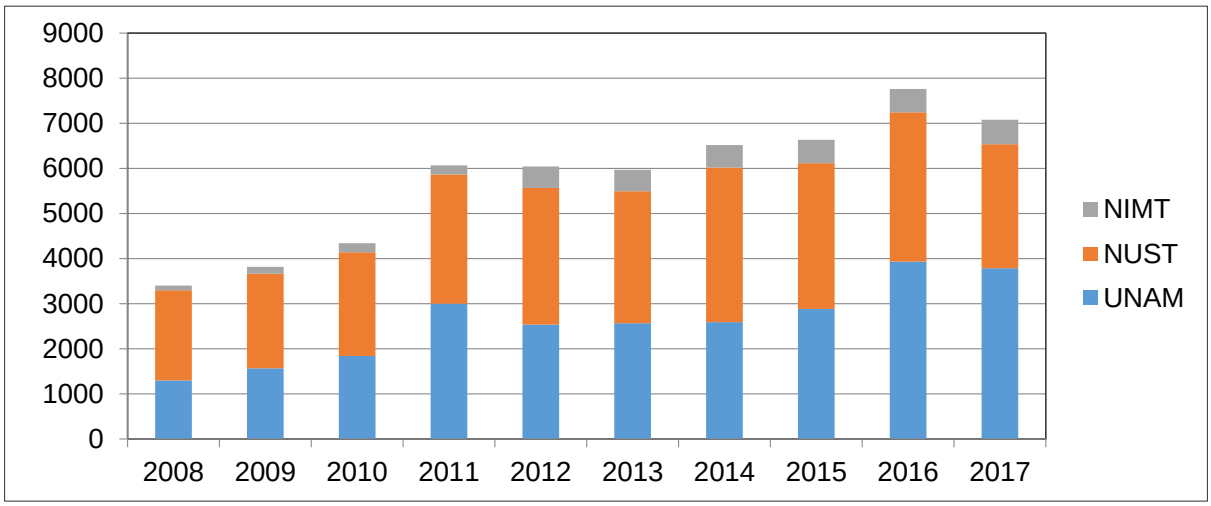

Figure 50: Number of Graduates from NIMT, UNAM and NUST

Motivation of status: The indicator was rated as **MET** because there was a long-term increase in the number of graduates from the relevant institutions over the last ten years, even if the figures in 2017 were slightly lower than in 2016.

Indicator 9.2.1.2.	Every mine has or funds a skills development programme for employees (3% of wage cost).
Data Source	NUA
Status:	NOT MET

This indicator only applies to operating mines (Langer Heinrich Uranium, Rössing Uranium and Swakop Uranium); other companies are included in Table 34 for information only. Langer Heinrich's percentage of wage cost allocated to skills development decreased from 6.7% in 2016 to 2.3% in 2017. This figure refers to internal and external training, job attachment salaries and VET levy contributions. It excludes skills development through the community support programme (see comments in the introduction to EQO 9). Rössing Uranium's contribution of 15% of wage cost was well above the target. AREVA Resources Namibia and Bannerman Mining Resources allocated 1.3% and 3% of wage cost to skills development programmes.

Table 34: The Mining Industry's Contribution to Skills Development in 2017

Company	Skills development in 2017 (internal and external)			
Number of:	NIMT & NTA apprentices	Work permits	Bursary holders	% of wage cost
AREVA	5	0	2	1.3%
Bannerman	5	0	2	3%
Langer Heinrich	83	20	0 bursaries, 3 employee education assistance	2.3%
Rössing Uranium	30 (internship)	5	10 bursaries, 19 empl. assistance, 34 employee dependents	15%
Swakop Uranium	35	No data	4	No data

Motivation of status: Swakop Uranium did not supply sufficient data and Langer Heinrich Uranium did not meet the target of 3%, which means the indicator was **NOT MET**, as the requirement is for each mine to fund a skills development programme.

Indicator 9.2.1.3.	Each mine has 10% more bursary holders than work-permit holders.
Data Source	NUA
Status:	NOT MET

In 2017, Rössing Uranium had twice as many bursary holders as work permit holders, i.e. 10 students received bursaries (Table 34). Seven of these were new bursaries in the fields of chemical, mining and mechanical engineering and chemistry in line with the mine's operational requirements. The Rössing dependent scholarship scheme supported 34 students at tertiary level and 19 employees

pursued part-time and full-time studies. The mine also offered 30 trade-related job attachments and one apprenticeship.

At Langer Heinrich Uranium the number of work-permit holders was 20 in 2017, while no external bursaries were awarded. Due to financial constraints it was impossible to increase the number of bursaries in line with the indicator. Langer Heinrich Uranium complies with the requirements of the Employment Equity Act and has understudies in place for all non-Namibian employees. The company also offered job attachments to students in the fields of mechanical engineering and metallurgy. Furthermore apprenticeships were offered to students in the trades of fitter & turner, boilermaker, electrician, control and instrumentation technician and diesel mechanic.

Swakop Uranium awarded four new bursaries in 2017. Though the number of work permit holders was not provided, personal observation suggested that the company employed more than four non-Namibians.[96]

AREVA Resources Namibia continued supporting two students who had received bursaries in 2015 and will graduate in 2018. Bannerman Mining Resources also supported two bursary holders in 2017; the company has no work permit holders.

Motivation of status: While Rössing Uranium exceeded this indicator, Langer Heinrich Uranium had more work-permit holders than bursary holders. As the indicator requires each mine to have 10% more bursary holders than work-permit holders this was **NOT MET** for 2017.

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Summary of performance: EQO 9

Total no. indicators assessed 7

	NOT MET	IN PROGRESS	MET	EXCEEDED
Number of indicators in class	6	0	1	0
Percent of indicators in class	86%	0%	14%	0%

Overall performance: Six of seven education indicators were **NOT MET** (86%), only the indicator requiring an increase in the number of graduates from tertiary and vocational training institutions was **MET** (14%). Four indicators that were **NOT MET** concerned the performance of schools in the Erongo Region in terms of improved Grade 10 and 12 examination results and teacher to learner ratios. The other two indicators revealed that some operating mines failed to spend 3% of total wage cost on training and did not allocate 10% more bursary holders than work-permit holders.

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[96] Pers. comm. NUA, 2018

EQO 10. Governance

Aims of this EQO: Regulators and industry protect Namibia's reputation as a responsible uranium producer by means of ethical conduct and environmentally, socially and financially responsible practices.

The future of Namibia's uranium industry can only be safeguarded if all government and industry stakeholders subscribe to ethical conduct and internationally accepted social, environmental and economic standards. International power utilities are free to choose where they purchase nuclear fuel, but they subscribe to best practice standards that require 1) that their business partners are responsible mining companies, 2) that countries supplying uranium do their best to eliminate corruption.

EQO 10 has been revised in 2018 to incorporate the two indicators related to Namibia's reputation as a responsible uranium producer that were previously included under EQO 11. These indicators assess the uranium industry's international reputation by reviewing national and international online media to find any critical reports that may influence key international stakeholders.

The Governance EQO also evaluates the way in which mining and prospecting licences are awarded and check whether government agencies enforce the applicable legislation for the protection of the environment and exercise appropriate supervision over mining operations. Mining is regulated under the Minerals Act of 1992, the Atomic Energy Act of 2005 and the Environmental Management Act of 2007.

Desired Outcome 10.1.	**Prospecting and mining avoids environmentally high value, sensitive areas.**			
Target 10.1.1.	**Sensitive areas in need of protection are not generally available for prospecting or mining.**			
Indicator 10.1.1.1.	**Declared 'red flag' areas undergo the required high level of scrutiny before mineral licenses are considered.**			
Data Source	**SEMP Office/MME/MET**			
Status:				

Indicator 10.1.1.2.	**Where possible, red flag areas remain undisturbed by mining or other developments that have high impacts on biodiversity, heritage and/or sense of place.**			
Status:				

Indicator 10.1.1.3.	**If development (especially mining) is to take place in a yellow flag area, strict conditions are attached with the approval certificate.**
Data Source	**SEMP Office/MME/MET**
Status:	

Uranium exploration and mining activities occur in ecologically-sensitive parts of the Namib Naukluft National Park and the Dorob National Park. Namibia is probably unique in the world for allowing mining in national parks, though a Policy on Prospecting and Mining in Protected Areas has been drafted to prohibit prospecting and mining in sensitive areas of high biodiversity, heritage or tourism value. The 'no-mining areas' in the policy can be equated to the 'red flag' areas of the SEA; the policy does not recognise 'yellow flag' areas that would require a lesser degree of protection. As mentioned under EQO 7 and EQO 8 the policy does not cover all the areas recommended in the SEA.

Motivation of status: The three indicators were **NOT APPLICABLE** because MME did not issue any new mining licences for nuclear fuels in red or yellow flagged areas in 2017.

Indicator 10.1.1.4.	**No new power lines, pipelines or roads linked to uranium mining are routed through red flag areas, and preferably also not through yellow flag areas, nor interfere with ecological processes (such as migration routes for example)**
Data Source	**SEMP Office/MET/NUA**
Status:	

There were no new infrastructure developments in red or yellow-flagged areas in 2017.

Motivation of status: The indicator was **NOT APPLICABLE.**

Desired Outcome 10.2.	**Good governance is maintained in the issuing of mineral licenses.**
Target 10.2.1.	**The defined process is always followed in the allocation of all kinds of mineral licenses and the establishment of supporting infrastructure.**
Indicator 10.2.1.1.	**Mineral licenses are given only after full consultation of, and consensus within, the Mineral Rights Committee and considering the relevant status of areas in question (red and yellow flag areas).**
Data Source	**SEMP Office/MME/MET**
Status:	

A document issued by MME confirmed that mineral licences are issued to applicants after consulting the Mineral Prospecting and Mining Rights Committee (MPMRAC) and obtaining an Environmental Clearance Certificate.[97] In the past, mining companies have however won court cases against MME when ML applications were refused for environmental reasons because the court found that MME was not the competent authority to decide on environment conservation. [98] It is therefore important to strengthen MET representation on the MPMRAC and ensure that the Environmental Commissioner refuses environmental clearance for projects in red and yellow flag areas.

Bannerman Resources obtained a mineral deposit retention licence (MDRL 3345) over part of their existing EPL, which is in a yellow-flagged area; the licence for the rest of the EPL 3345 was renewed, while the mining licence for the Etango project is still pending.

Information about the full consultation and consensus within the MPMRAC when a mining licence was issued to Namibia Nuclear Corporation in 2017 was not available (see next indicator), but the affected area is not red or yellow-flagged.

Motivation of status: This indicator was **NOT APPLICABLE**.

Indicator 10.2.1.2.	**No evidence of corruption in the allocation of mineral licences.**			
Data Source	**SEMP Office/MME**			
Status:	**NOT MET**			

MME described the procedure for a mining licence application as follows:[99]

a) The Mining Commissioner receives all applications.
b) Technical staff members of the Department of Mines conduct preliminary evaluation on each application and forward their recommendations to the Mineral Prospecting and Mining Rights Advisory Committee (MPMRAC), an inter-Ministerial Committee.
c) MPMRAC meets about once every two months to look at applications. The assessment follows the order in which the applications were received – section 125 of the Minerals Act. After assessing each application, the MPMRAC forwards their recommendations to the Minister.
d) The Minister makes the final decision on each application.

In the same document, the evaluation criteria for MLs are listed as follows:

- Eligibility: i) in case of a company, it should be duly registered in Namibia for the purpose of mineral exploration and mining, ii) if it is an individual, he or she must be a Namibian citizen.
- Sound exploration or mining program and budget;
- Capability to finance the exploration or mining project;
- Environmental clearance certificate from Ministry of Environment and Tourism;
- Sound report detailing resources and reserves (SAMREC, JORC, etc. compliant);
- Sound track record in exploration/mining;
- Sound mine design and processing plant design (MLs);

[97] MME (2018): Licences, Rights and Permits Application Guidelines and Assessment Process
[98] Pers. comm. NUA, 2017
[99] MME (2018): Licences, Rights and Permits Application Guidelines and Assessment Process

- Pre-feasibility study (MLs).
- Availability of mining experts to carry out the envisaged mining program, if applicant has no in-house capacity, a reputable mining contractor is required;

MME issued one new uranium mining licence in 2017 to Namibia Nuclear Corporation. The company had a mining licence for dimension stone, which was amended to include nuclear fuels. It was not clear if compliance with the requirements listed above applies in case of amendments.

Motivation of status: No information about the procedure followed in granting a new mining licence in 2017 was provided in order to assess whether the process was in line with legal requirements. The indicator was therefore regarded as **NOT MET**.

Indicator 10.2.1.3.	**No prospecting, mining or major infrastructure projects are permitted before full EIAs are completed and approved. Minimum EIA standards as in the EMA and regulations, are adhered to, including:** **- Clear TORs** **- Use of independent consultants** **- Public consultation** **- Specialist studies** **- Consideration of alternatives** **- Avoid and/or minimise adverse impacts** **- Include an EMP and closure and restoration plan** **- Professional review of EIAs and EMPs**			
Data Source	**SEMP Office/MME/MET**			
Status:			**MET**	

Swakop Uranium was the only company that did EIAs in 2017. They reported that the process was handled professionally by an external independent consultant and all the required items were included and investigated. The Scoping Report and EMP update were published for comment and then submitted to MET: DEA for approval in 2018.

Motivation of status: The indicator was **MET**.

Desired Outcome 10.3.	**Prospecting and mining activities are properly monitored.**			
Target 10.3.1.	**Post-implementation monitoring is regular, efficient and outcomes-based.**			
Indicator 10.3.1.1.	**GRN agencies (notably MME, MET, MAWF, MHSS) inspect active mines at least once per annum, and closed mines at least once every 3 years.**			
Data Source	**SEMP Office/MME/MET/MAWF/MHSS**			
Status:		**IN PROGRESS**		

Various government institutions are responsible for the implementation of this EQO. In the Ministry of Mines and Energy (MME), the Division of Engineering and Environmental Geology (DEEG) in the Geological Survey of Namibia (GSN) and the Mines Inspectorate in the Directorate of Mines are mandated to monitor current and abandoned mine sites. Abandoned mines are monitored according to the risk they pose. Those classified as "mining environmental liability" are regularly monitored and precautionary measures are taken where necessary. Table 35 lists the government inspections conducted at mines and exploration sites in 2017.

MET's Directorate of Environmental Assessment (DEA) requires regular reports on the status of the environment to assess the mines' compliance with their environmental management plans and does site inspections from time to time. MAWF's Directorate of Resource Management (DRM) inspects mines for compliance with groundwater abstraction permits and industrial and domestic wastewater discharge permits. They occasionally collect water samples for independent analysis. The Ministry of Health and Social Services (MHSS) inspects and licences health-care personnel and facilities at mines, e.g. first-aid stations or clinics.

Table 35: Government Inspections of Uranium Mines and Projects in 2017

Company	**Government Agencies (date, what was inspected)**
Rössing Uranium	MAWF DWAF: Inspection of Wastewater and Effluent Disposal Exemption Permit 674 compliance with permit conditions
Langer Heinrich Uranium	16 March: MET Directorate of Parks and Wildlife: Inspection of TSF3 fence and animal waterhole 27 June and 16 November: MAWF DWAF Directorate Resource Management: Groundwater quality monitoring in the Swakop River and water pollution control investigation
Swakop Uranium	30 May: DWAF Water Environment Team followed up reported TSF seepage return water system spillage incident; DWAF team took spillage samples 01-02 June: MET DEA followed up reported TSF seepage spillage incident 08 June: MET DNPW Park Warden and Ranger followed up reported incident regarding the TSF seepage return water system spillage 12 June: MHSS NRPA conducted compliance visit of Husab Mine and assessed the TSF seepage return water system spillage 09 August: MET DEA Environmental Commissioner and supporting delegates visited to better understand the TSF seepage return water spillage situation as reported and for MET to conduct a follow-up on the status of the rehabilitation and corrective actions for the incidents 06 October: MET DEA team followed up on a slurry spillage incident that was reported during September 2017 on the TSF eastern wall as a result of a pipeline failure; a progress update on rehabilitation regarding TSF seepage return water system spillage was also conducted 15 November: DWAF Water Environment team re. application for effluent permit and inspection of wastewater treatment facilities 24 November: MET DEA Environmental Commissioner and supporting delegates, including NNNP Representative conducted environmental compliance inspection including general mine operations and rehabilitation of TSF spillage incidents
Reptile MR	MET NNNP Warden signed off rehabilitated areas in 2017 Ministry of Finance visited in March 2018

The National Radiation Protection Authority (NRPA), which resorts under MHSS, conducts inspections for compliance with the relevant legislation and the mines' radiation management plans. The Ministry of Labour, Industrial Relations and Employment Creation (MLIREC) is also involved, particularly in inspecting working conditions.

Motivation of status: The relevant government agencies, DWAF, MET and MHSS/NRPA, carried out several inspections at Husab mine, while other mines only received one or two visits in 2017. Since the indicator defines "proper monitoring" as an inspection at least once per annum, it would be preferable if all relevant ministries conducted regular site inspections at active mines. Closed mines, at least those posing an environmental risk, should be inspected at least once every three years. Because there was room for improvement the indicator was considered to be **IN PROGRESS**.

Indicator 10.3.1.2.	**Honorary conservators are appointed by MET to assist with monitoring, including of unauthorized secondary (off-mine) activities such as off-road driving, poaching and littering.**			
Data Source	**SEMP Office/MME/MET**			
Status:		**IN PROGRESS**		

As reported under Indicator 8.4.1.2, the Protected Areas and Wildlife Management Bill makes provision for the appointment of honorary conservation officers: [100] *144 (1) The Minister may in writing delegate any power conferred upon him or her by or under this Act, except the powers to make regulations and to hear reviews, to any officer in the Ministry or to any officer of the Ministry or any honorary conservation officer or a conservancy member.*

It is hoped that MET will make use of this option once the bill has been promulgated. In the meantime, Swakop Uranium has taken the initiative of reporting to MET: Parks & Wildlife when they come across indications of poaching activities in the parks or associated river systems. It is suggested that the intent of the indicator could be met if all interested members of the public or mine employees play a role in monitoring and reporting secondary impacts by contacting the NNNP Wardens directly.

Motivation of status: The new bill provides the opportunity of appointing honorary conservator officers. This indicator can be rated **IN PROGRESS** until the legislation is in place.

Indicator 10.3.1.3.	**International agencies regularly inspect mines and provide independent opinion on their performance.**			
Data Source	**SEMP Office/MME**			
Status:			**MET**	

The International Atomic Energy Association (IAEA) is the designated international agency mandated to inspect uranium mines under the Nuclear Safeguards Agreement concluded with the Namibian government. The IAEA Safeguards are a system of inspection and verification of the peaceful uses of nuclear materials as part of the nuclear non-proliferation treaty (NPT). The IAEA safeguards nuclear

[100] MET: Protected Areas and Wildlife Management Bill, 31 August 2017

material and activities under agreements with more than 140 states.[101] Matters such as the mines' environmental performance or sustainable development issues are however beyond the scope of the Safeguards Agreement.

These aspects are covered by the Equator Principles established by the International Finance Corporation (IFC). The Equator Principles are a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in project finance.[102] Financial institutions in 35 countries have officially adopted the Equator Principles, meaning that mining companies wanting to access international project finance in emerging markets are required to abide by the principles. Mining companies will state in their EIAs and EMPs that these documents were developed in compliance with the Equator Principles. Compliance is independently audited, for instance as part of the annual ISO 14001 environmental management system audits at operating mines.

Another relevant international agency is the World Nuclear Association (WNA). Though the WNA does not physically inspect Namibian uranium mines it has issued a very comprehensive self-assessment reporting tool that companies should complete in order to demonstrate compliance with the International Council on Mining and Metals (ICMM) sustainable development principles, the Global Reporting Initiative (GRI) and other international best practice standards.[103] The checklist is a useful tool to collate the required data and documentation for audits. Such audits are carried out by the mines' international customers, for instance.

Motivation of status: The current level of international oversight by the IAEA and the mining industry's voluntary compliance with the Equator Principles, ICMM sustainable development principles, GRI and WNA requirements is regarded as sufficient to rate the indicator as **MET**.

Indicator 10.3.1.4.	**Results of monitoring improve practice and are disclosed to the public through existing channels and in an annual SEMP report, or more regularly.**			
Data Source	**SEMP Office**			
Status:			**MET**	

Annual SEMP reports that are freely available to the public on the MME or NUA websites present the results of monitoring related to uranium mining. The reports contain an action plan that is compiled to identify shortcomings and improve practices. More regular reports are published about certain topics of interest, such as the advanced air quality study. GSN and NUA also cooperate on scientific articles and public lectures, e.g. about groundwater monitoring results in the Khan and Swakop rivers and the health effects of radon gas.

Motivation of status: The indicator was **MET** because monitoring results are published in annual SEMP reports that are freely available to the public and that are used to improve practices.

[101] https://www.iaea.org/publications/factsheets/iaea-safeguards-overview
[102] International Finance Corporation "Equator Principles"
[103] World Nuclear Association (2015): Internationally Standardized Reporting (Checklist) on the Sustainable Development Performance of Uranium Mining and Processing Sites

Desired Outcome 10.4.	**Non-compliance is rectified.**			
Target 10.4.1.	**Transgressions are noted and acted upon timeously.**			
Indicator 10.4.1.1.	**The activities of proponents / developers / service providers, who have caused unauthorised negative impacts, are suspended, and they are forced to remedy impacts.**			
Status:			**MET**	

Indicator 10.4.1.2.	**If impacts are not remedied, the operation is closed and the project authorisation is cancelled.**			
Status:			**MET**	

Indicators 10.4.1.1 and 10.4.1.2 are related and assessed together. In case of environmental transgressions MET issues compliance orders to parties that do not comply. They are given 21 days to achieve compliance before their clearance is revoked. When a compliance order is issued all activities must stop until the case has been cleared. No cases of compliance orders or clearances being revoked were reported in 2017. [104]

Motivation of status: Both indicators were **MET**.

Indicator 10.4.1.3.	**Fines are issued for non-compliance.**			
Data Source	**SEMP Office/MME/MET**			
Status:		**IN PROGRESS**		

Currently, the Environmental Management Act (Act No. 7 of 2007) does not empower the Ministry of Environment and Tourism to issue fines; hence none have been issued so far. [105] The regulations to the Environmental Management Act, which are currently in draft form, will however make provision for fines and other penalties for environmental offences.

Motivation of status: The indicator was **IN PROGRESS** because the proposed regulations to the EMA will make provision for fines.

[104] Pers. comm. Ministry of Environment and Tourism, 2018
[105] Pers. comm. Ministry of Environment and Tourism, 2018

Indicator 10.4.1.4.	**All incidences of non-compliance are publicised through the media and noted in the annual SEMP report.**
Data Source	**SEMP Office**
Status:	

The draft amendment of the Environmental Management Act (Act No. 7 of 2007) does not make provision for the reporting of non-compliance cases in the media. MET will however report transgressions in its contribution to the annual SEMP reports. As reported above, no compliance orders were issued in 2017.

Motivation of status: The indicator was **NOT APPLICABLE**.

Desired Outcome 10.5.	**The good reputation of Namibian uranium is maintained.**
Target 10.5.1.	**The 'Namib uranium province' is regarded internationally as an area where ethical, environmentally, socially and financially responsible companies prospect and mine uranium.**
Indicator 10.5.1.1.	**No published evidence about unethical practices in the Namib uranium province.**
Data Source	**SEMP Office**
Status:	**MET**

The following newspaper archives were searched for articles related to uranium mining published in 2017: Namibia Economist, Namibian Sun, The Namibian, and Windhoek Observer. International media usually only pick up issues that were first reported in the local papers or online. An internet search did not encounter any critical international reports. A review of the local media review is shown in Table 36. Most of these articles reported the facts without bias for or against uranium mining. The prevailing topics related to the uranium market outlook and developments at various companies. More critical or negative reports relevant to this indicator can be grouped under the following topics that are described in more detail below.

Rössing pension fund[106]

Summary of several articles: "*Mining company Rössing Uranium and the Rössing Pension Fund won their Supreme Court appeal against a High Court judgement, in which a decision about the distribution of a pension fund surplus of more than N$450 million was set aside a year ago. Appeal judge Dave Smuts found that the Rössing Uranium board of directors' decision in February 2012 about the distribution of an actuarial surplus in the fund was in line with one of the pension fund's rules, which states that the company should decide, after considering recommendations made by the fund's trus-*

[106] Rössing wins appeal on pension surplus by Werner Menges, The Namibian, 3 July 2017, Rössing victorious in pension fund saga, Namibian Sun, 3 July 2017

tees, how to deal with a surplus in the fund. Former members of the pension fund sued the company, and the fund after the board decided that 15% of the surplus in the pension fund was to be allocated to former members, 52% to current members, and 33% to the company."

Spill at Swakop Uranium tailings facility[107]

Early reports about Swakop Uranium investigating claims that the tailings storage facility at its Husab mine was leaking dangerous waste material into underground water sources appeared on social media with the photo in Figure 51. *The tailings dam is where the waste from heavy and radioactive metals such as uranium, thorium and radium, washed with sulphuric acid, is stored. "A leak could pose a major environmental threat to the Swakop groundwater supply, as those metals cause an increase to levels of radon gas, which permeates into the ground water," the source of the photo and information claimed, accusing the company of poor management and construction.* The same article stated correctly that Swakopmund's drinking water is supplied from the Omdel aquifer and the Erongo desalination plant, not from the Swakop River.

Figure 51: Husab Mine Tailings Facility with Water Spill

Articles in July 2017 contained Swakop Uranium's statement that *"the pumps at some of the lined seepage collection ponds partially failed, and with the continuous inflow of the seepage water, it resulted in the lined seepage ponds overflowing onto the unlined surroundings. It should be noted that the spillage took place in a small localised area, still within the perimeter of the tailings storage facility fence, which is not accessible to the public or animals. The tailings dam, including the wall of the dam itself, has no leakages, and operates as per normal practice. Seepage from the tailings storage facility drains into lined seepage collection ponds, from where it is pumped back to the processing plant for re-use to save water. Investigation by the Department of Environmental Affairs, the National Radiation Protection Authority, the Ministry Agriculture, Water and Forestry, and an external environmental consultancy confirmed that the spillage incidents were directly caused by the pump failures at some of the seepage ponds. When the regulators examined the area, the seepage ponds were no longer overflowing as corrective action had already been taken to repair the pumps."*

[107] Swakop Uranium investigates waste leak by Adam Hartmann, The Namibian, 29 May 2017; Husab tailings facility leaked due to pump failure by Adam Hartmann, The Namibian, 17 July 2017; Faulty pumps to blame for Husab waste leak, Namibian Sun, 17 July 2017; Husab leak still causing friction by Adam Hartmann, The Namibian, 9 August 2017

Table 36: Media Headlines Related to Uranium Mining

Month	Headlines
January 2017	Govt lifts ban on uranium exploration applications Paladin to keep 75% of Langer Heinrich Paladin in dire straits AREVA to remain mothballed Uranium pressures bite hard Husab produces first uranium oxide
February 2017	Husab to reach full capacity by August 2018 Processing plant for U-pgrade tech Bannerman launches updated feasibility study Husab construction completed
March 2017	Depressed uranium prices present a challenge Husab ramps up, despite commodity prices First lady's foundation gets stake in uranium mine Chinese attempt hostile takeover at Langer Heinrich
April 2017	$107m profit for Rössing Why Rio Tinto must go! Chinese propose nuclear plant
May 2017	Russians rekindle interest in nuclear plant Swakop Uranium investigates waste leak Langer Heinrich valuation for restructuring
June 2017	India, France join race to build nuclear energy plant Marenica test technology Recent drilling results at Tumas 3
July 2017	Rössing wins appeal on pension surplus Rössing victorious in pension fund saga Husab tailings facility leaked due to pump failure Faulty pumps to blame for Husab waste leak Bannerman, Geingos Foundation deal sealed Lifeline for Langer Heinrich owner
August 2017	Paladin to retain Langer Heinrich Husab leak still causing friction Deep Yellow restructures, continues exploration
September 2017	Langer Heinrich test processing tech Mining drives the economy Dire outlook for uranium miners Mineral resource estimate at Tumas 3 impressive
October 2017	Etango granted retention licence
November 2017	Husab mine workers protest Swakop Uranium counters grievances by workers Marenica challenges mining conventions
December 2017	Membrane study initial test work at Etango New uranium deposit discovered

The last article in August 2017 referred to a statement by environmental watchdog Earthlife Namibia in which it accused Swakop Uranium of downplaying the risks of the leak to the environment and human health. Swakop Uranium reiterated that the company did all it could to contain and fix the problem, and gave an assurance that there was no risk to the environment or people. The soil was neutralised and the small area affected by the spill was rehabilitated. Drill samples showed that the seepage did not infiltrate deeper than a few metres, i.e. it did not reach the groundwater.

Earthlife Namibia contacted the Ombudsman who conducted an inspection in 2018 and concluded that he was satisfied with the management of the incident. He sent a response in this regard to Earthlife Namibia and closed the case.[108] Other government institutions did follow-up inspections (see Indicator 10.3.1.1) and found that Swakop Uranium's response to the spill was adequate.

Industrial relations at Swakop Uranium[109]

The Mineworkers Union of Namibia Swakop Uranium branch handed over a list of complaints about salaries and job grading, non-Namibians not having Namibian understudies, shift times, recruitment, company policies, and the conduct of some of the company's managers. *"The workers claimed to be negatively affected by the [blanket] grading system where they are appointed based on their previous income, irrespective of the position in which they are employed. This meant that workers performing jobs of equal value were receiving different salaries."*

Swakop Uranium countered these claims, saying that the company had a salary structure, which included minimum and maximum levels, based on the Affirmative Action report, which is an official document. *"In addition to the basic salary scale, the company provides excellent benefits to employees, such as pension and medical schemes."* Referring to wage negotiations, the company explained to MUN the definition of a job-grading system, which is the process of determining systematically and objectively, without regard for personality and individual competency, the worth of one job relative to another as a management guideline. Grading the different roles within the bargaining unit constitutes a formalised grading system. The company further stated that the Chinese recruits were serving as communicators between the majority shareholders and the company for the construction of the mine, smooth ramp-up of the operations, and continued stable operations. These positions were therefore exempted from having Namibian understudies.

Evaluation of reports: Taking into account the outcome of the Supreme Court case as reported above, it seems that Rössing Uranium followed the correct procedures and could not be accused of financially irresponsible conduct as per the indicator definition. The Ombudsman was satisfied with the way in which the spill at Swakop Uranium was handled. One could thus conclude that it was in accordance with environmentally and socially responsible principles. Seeing that the Ministry of Labour approved Swakop Uranium's affirmative action plan for 2017, it is likely that the company complied with the required conditions, notwithstanding the published labour issue. It was not possible to substantiate allegations of financially or socially irresponsible behaviour.

Motivation of status: The indicator was redefined in 2018 as "no published evidence about unethical practices in the Namib uranium province." The Namibian media published articles about three events that members of the public could potentially interpret as instances of unethical or environmentally, socially or financially irresponsible behaviour. The Rössing Supreme Court judgement served as published evidence and unpublished information confirmed that the Swakop Uranium cases were cleared up. The indicator was **MET**.

[108] Pers. comm. Swakop Uranium, 2018

[109] Husab mine workers protest by Adam Hartmann, The Namibian, 20 November 2017; Swakop Uranium counters grievances by workers by Adam Hartmann, The Namibian, 24 November 2017

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Summary of performance: EQO 10

Total no. indicators assessed	10 (6 were **NOT APPLICABLE**)			
	NOT MET	**IN PROGRESS**	**MET**	**EXCEEDED**
Number of indicators in class	1	3	6	0
Percent of indicators in class	10%	30%	60%	0%

Overall performance: The six EQO 10 indicators that were **MET** (60%) relate to the correct EIA process being followed, international checks on the uranium industry's performance, the availability of monitoring results in annual SEMP reports, action taken to address EMP non-compliance and no published evidence of unethical conduct. Three indicators were **IN PROGRESS** (30%) because many GRN agencies postponed their annual inspections at active mines or three-yearly inspections at closed mines and the regulations that will enable the Ministry of Environment & Tourism to appoint honorary conservation officers and to levy fines were still pending. The indicator regarding corruption in the allocation of mining licences was **NOT MET** (10%). Six indicators were **NOT APPLICABLE** because MME did not issue new licences for uranium prospecting or mining in red or yellow flag areas and MET did not issue any compliance orders.

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EQO 11. Heritage

Aims of this EQO: Uranium exploration and mining and related infrastructure developments will have the least possible negative impact on archaeological and paleontological heritage resources. Survey, assessment and mitigation will result in significant advances in knowledge of archaeological and paleontological heritage resources, so that their conservation status is improved and their use in research, education and tourism is placed on secure and sustainable footing.

EQO 11 defines measure to protect the archaeological sites in the uranium province and to ensure significant advances in scientific knowledge. The Central Namib is home to some of Namibia's key heritage resources with an archaeological history dating back more than a million years. Significant human evolutionary development and specific adaptations to extreme aridity and environmental uncertainty are evident. Some of the archaeological sites are obvious to any observer, such as rock art or historical mines. Others, such as pre-colonial stone features or surface scatters of stone artefacts are virtually invisible to the untrained eye. This means that archaeological sites have to be located and identified before the start of mining projects to avoid damage. Consequently, it has become regular practice to carry out archaeological surveys and assessments at the earliest possible stage of exploration, mine development or expansion.

Desired Outcome 11.1.	**The integrity of archaeological and paleontological heritage resources is not unduly compromised by uranium mining.**
Target 11.1.1.	**Mining industry and associated service providers avoid impacts to archaeological resources, and where impacts are unavoidable, mitigation, restoration and /or offsetting are achieved.**
Indicator 11.1.1.1.	**All mining and related developments are subject to archaeological and paleontological assessment** **No unauthorised impact occurs**
Data Source	**NERMU/MET/NUA**
Status:	

During the 'uranium rush' all new projects at mines and exploration sites were subject to the EIA or scoping process during which the need for archaeological assessments was identified. A large number of archaeological surveys carried out during this time resulted in a significant increase in scientific knowledge.

The current mining scenario resulted in a decline in new projects that would require archaeological research. Operating mines have procedures to safeguard any unexpected finds and consult specialists on the way forward. However, no such finds and no authorised impacts were reported in 2017.

Indicator 11.1.1.2.	Mining companies adhere to local and international standards of archaeological assessment**.**
Data Source	**NERMU/MET/NUA**
Status:	

No archaeological assessments for new projects or existing mines were carried out in 2017.

Motivation of status: Indicators 11.1.1.1 and 11.1.1.2 were **NOT APPLICABLE**.

Desired Outcome 11.2.	**Integration of archaeological and environmental knowledge in a balanced working model of Namib Desert environmental processes.**
Target 11.2.1.	**Development of a general research framework to identify gaps in scientific knowledge.**
Indicator 11.2.1.1.	**Research in progress.**
Data Source	**NERMU/MET**
Status:	**MET**

When the SEA report and the SEMP were compiled it was expected that the development of new mines would be accompanied by continuous archaeological research. Even though the current mining scenario does not support ongoing research, the results of studies carried out during the boom-years were incorporated in books or papers such as 'A history of Namibia: from the beginning to 1990'[110] and 'Post-Pleistocene archaeology and geomorphological processes on the Namib Desert coast'.[111]

The Namib Desert has by far the longest archaeological record of all southern hemisphere deserts (approximately 800 000 years), according to the article, although human occupation was patchy and episodic, mainly due to a severe lack of water resources. While the coastline has yielded little evidence of sustained settlement, the mid-Holocene to recent precolonial period was well represented by dense local concentrations of surface remains. These sites allowed reconstruction of key periods, including the richest and most detailed record of indigenous contact with early European maritime traders on the southern African coastline. The potential for advanced research on the Namib Desert coast remains high and the Namib Desert Archaeological Survey initiative has made proposals for new archaeological conservation areas in partnership with traditional desert communities.

Motivation of status: The indicator was **MET** because the information gathered during previous years is still contributing to the development of an archaeological history of the Namib.

[110] John Kinahan: A history of Namibia: from the beginning to 1990, unpublished, available on request

[111] John Kinahan and Jill Kinahan (2016): Post-Pleistocene Archaeology and Geomorphological Processes on the Namib Desert Coast of South Western Africa. Journal of Island and Coastal Archaeology

Indicator 11.2.1.2.	Working model of Namib Desert developed.			
Status:			MET	

Dr John Kinahan, who proposed the indicators related to an archaeological model in the SEA, has in the meantime used the data collected in the Namib over many years to develop a model based on the concept of CS Holling's adaptive cycle for Holocene human adaptation in the desert.[112] He found that the climatic amelioration during the mid-Holocene was associated with hunter-gatherer occupation of remote sites in the Namib Desert. Subsequent changes in the late Holocene site distribution suggested that there were alternative responses to increasing aridity during this period: Abandonment or episodic occupation was evident in some areas, while others showed an emphasis on mountain refuges and resource anomalies.

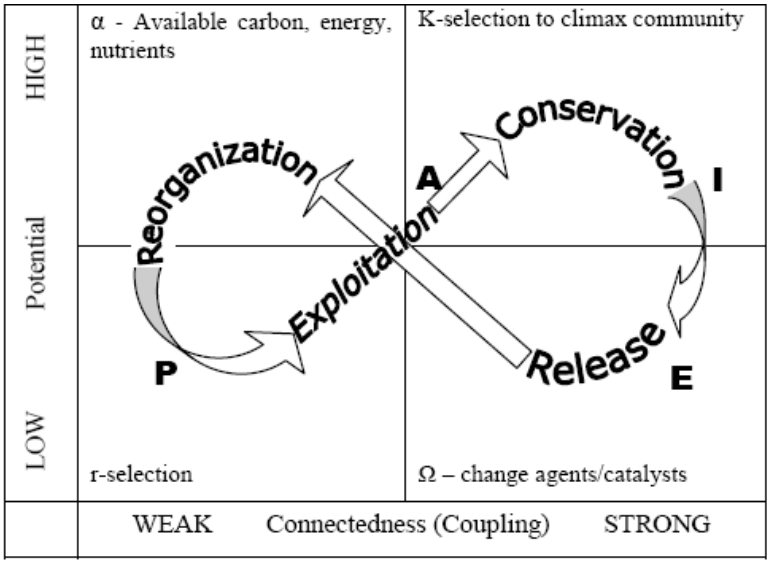

Figure 52: Illustration of Holling's Adaptive Cycle (via Google)

People developed specialized coping strategies during this time allowing a broad re-occupation of the desert when conditions improved briefly during the Medieval Warm Epoch. Successive patterns of settlement and subsistence in the Namib Desert Holocene sequence exemplify the four moments of Holling's adaptive cycle (Figure 52).

A related article about human responses to climatic variation was based on the results of radiocarbon dating of camelthorn trees in the Namib Desert.[113] The data were found to reflect marked variations in rainfall during the last 1,000 years. These records and other climate data indicated a loose connection with the southern African climatic record, especially for dry conditions resulting from extreme El Niño events. However, in contrast to the climate record archaeological evidence of hunter-gatherer and nomadic pastoralist occupation revealed that the desert was not only inhabited during periods of good rainfall. It pointed instead to a specialized strategy that allowed continuous

[112] Kinahan, J. (2017): Holocene human adaptation in the Namib Desert: A model based on the concept of Holling's loop. Published on www.wits.academia.edu/JohnKinahan

[113] Kinahan, J. (2016): Human Responses to Climatic Variation in the Namib Desert during the Last 1,000 Years. African Archaeological Review

occupation of the Namib Desert despite extreme fluctuations in rainfall, by combining the use of primary resource areas with opportunistic use of secondary, ephemeral resources.

Motivation of status: The indicator was **MET** because an initial approach to the proposed model has been developed.

Indicator 11.2.1.3.	**Model providing information to guide decision-making about development in the Namib desert.**
Status:	

Indicator 11.2.1.4.	**Development of diachronic models to determine the effects of climatic and other environmental changes.**
Data Source	**NERMU/MET/NUA**
Status:	

Seeing that Dr Kinahan did not directly contribute to the information evaluated in this report it was not clear at this stage whether the model would lend itself to the evaluation of development and environmental changes in the desert. Since the model based on Holling's adaptive cycle was only published recently, it is reasonable to expect further discussion and refinement to take place before it can be used to address these two indicators. This may be a lengthy process and probably subject to other priorities. In line with a decision by the SEMP steering committee in 2018 the indicators should be rated NOT APPLICABLE, rather than IN PROGRESS, unless there are visible results.

Motivation of status: The indicators were **NOT APPLICABLE**.

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Summary of performance: EQO 11

Total no. indicators assessed	2 (4 indicators were **NOT APPLICABLE**)			
	NOT MET	**IN PROGRESS**	**MET**	**EXCEEDED**
Number of indicators in class	0	0	2	0
Percentage of indicators in class	0%	0%	100%	0%

Overall performance: There was significant progress in archaeological research during the last two years, leading to two indicators being **MET** (100%). The development of diachronic models to determine the effects of climatic and environmental changes and to guide decisions about development in the desert is expected to proceed in due course; in the meantime these indicators will be rated **NOT APPLICABLE**. The indicators about the conservation of archaeological remains were **NOT APPLICABLE** since no archaeological assessments for new or existing mines were carried out in 2017.

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EQO 12. Mine Closure and Future Land Use

Aims of this EQO: To maximize the sustainable contribution mines can make post closure to society and the region, and to minimize the social, economic and biophysical impacts of mine closure.

The EQO aims to maximize the sustainable contribution that mines can make to society and the region post-mining. Mine closure is one of the industry's hardest sustainable development challenges because it is necessary to incorporate socio-economic aspects, along with infrastructure and biophysical aspects into the closure planning process. Closure plans should be drawn up as early as possible and be an integral part of the mining plan. If the shape of the ore body and open pit allow this option, rehabilitation should be undertaken progressively during the life of the mine. Sufficient financial resources must be allocated during and after mining to enable (progressive) rehabilitation and decommissioning of mine structures at final closure. Even though mining companies may not have sole responsibility for addressing the socio-economic impacts of mine closure, they are key players with significant power, influence and resources.

Namibia currently does not have legislation governing mine closure, although both MME and MET have started drafting amendments to the relevant acts. To fill this gap the Chamber of Mines of Namibia (CoM) has issued the Namibian Mine Closure Framework in 2010 to guide the mining industry on how to develop relevant, practical and cost-effective closure plans and to lay down minimum requirements for all Chamber members. Thus at the end of mine life, government agencies know what to expect, while companies are well prepared and have the necessary resources to implement the closure plan, ensuring that negative social, economic and biophysical impacts are minimized.

Desired Outcome 12.1.	**Companies have approved closure plans in place which ensure that there are no significant post-closure long term negative socio-economic, health and biodiversity effects from the mine. These plans should address planned as well as premature closure.**
Target 12.1.1.	• **The planning process is initiated early (in the feasibility study stage) to ensure that reasonable opportunities for post closure development are not prevented by inappropriate mine design and operations.** • **Mine closure plans need to be based both on expert and stakeholders input, and consider site-specific risks, opportunities and threats as well as cumulative issues. These must include socioeconomic opportunities for nearby communities and the workforce, demolition and rehabilitation and post closure monitoring and maintenance.** • **The plan needs to contain accepted and agreed objectives, indicators and implementation targets.** • **The plan needs to be subjected to periodic critical internal and external reviewed, must have written GRN approval.**

Indicator 12.1.1.1.	The contents of the plan are consistent with the IAEA guidelines, Namibian regulations and policies and the Namibian Mine Closure Framework.			
Data Source	SEMP Office/CoM/MME			
Status:			MET	

According to current practice operational mines have formal closure plans, while exploration companies only need a plan and financial provisions for site rehabilitation and retrenchments. All operational mines reported that the contents of their plans were consistent with the Namibian Mine Closure Framework that was developed based on International Atomic Energy Agency (IAEA) guidelines and international good practice, e.g. the West Australian Closure Standard that is regarded as leading practice (items 9 and 11 in Table 37).

Table 37: Feedback on Compliance with Closure Planning Requirements

Closure plan requirements	AREVA Namibia	Bannerman	Langer Heinrich	Rössing Uranium	Swakop Uranium	Valencia Uranium
1) Planning process started at feasibility study stage	Yes	Yes	Yes	No	Yes	Yes
2) Was based on expert and stakeholders input	Y/N	No	Yes	No	Yes	Yes
3) Considers site risks, opportunities, threats, and cumulative issues	Y/N	Yes	Yes	Yes	Yes	Yes
4) Socioeconomic opportunities for communities and workforce	Yes	Yes	Yes	Yes	Yes	Yes
5) Demolition, rehabilitation and post closure monitoring, maintenance	Yes	Yes	Yes	Yes	Yes	Yes
6) Contains accepted and agreed objectives, indicators and targets	No	No	Yes	Partly	Partly	No
7) Subjected to internal and external review	Yes	No	Yes	Yes	Yes	Yes
8) Written GRN approval	No	No	Yes	No	Yes	Yes
9) Consistent with IAEA guidelines	Yes	No	Yes	Yes	No	Yes
10) Namibian regulations and policies	N/A	N/A	Yes	Yes	Yes	N/A
11) Namibian Mine Closure Framework	Yes	Yes	Yes	Yes	Yes	Yes

It is expected that mine closure legislation will be incorporated in the regulations under the revised Minerals Act.[114] Closure of non-mining developments may be included in the revised Environmental Management Act.[115] Once these regulations have been promulgated, certain EIAs will have to be accompanied by a rehabilitation, closure and aftercare plan. The regulations will also specify the details to be contained in the plan and the financial guarantee for rehabilitation. Because these regulations are still under discussion item 10 was mostly marked not applicable (N/A). Companies that answered "yes" have received an ECC for a closure plan that was included in their EMP.

Table 37 also contains feedback on the items listed under the bullet points of Target 12.1.1. Regarding item 1, Rössing's feasibility study was completed in the early 1970s when closure planning was not considered in mine development. All other companies started the closure planning process at the feasibility study stage. Item 2: The plans were generally based on expert input and, if included in EMPs, also on public consultation or other stakeholder input. Y/N for item 7 in Table 37 means yes for expert input and no for stakeholder input. Item 3: Most plans considered site risks, opportunities and threats, whereas cumulative issues (several mines closing at the same time) were not always taken into account (Y/N). Socioeconomic opportunities for communities and the workforce (item 4) were included in all available plans.

Most companies have looked at demolition, rehabilitation and post closure monitoring and maintenance (item 5). The next three points should be considered together, starting with item 8 that requires written GRN approval. A formal process to obtain approval is not yet in place because Namibian policies and regulations specific to mine closure are still being drafted. The companies that responded "yes" to item 8 are referring to closure plans included in their EMPs and as such approved by MET as part of the environmental clearance process. Accepted and agreed objectives, indicators and targets (item 6) can only be developed once specific regulations are provided by GRN. Item 7: At this stage companies rely on corporate head offices, EIA consultants and/or ISO 14001 auditors to review the closure plans as there are no external reviews by government agencies.

Motivation of status: The indicator was **MET** because the operating mines have closure plans consistent with the Namibian Mine Closure Framework and IAEA guidelines.

Desired Outcome 12.2.	**Mines have adequate financial resources to close operations responsibly and to maintain adequate aftercare.**			
Target 12.2.1.	**The financial provision for mine closure needs to be based on cost calculations. Companies, in conjunction with regulators, need to establish an independent fund to provide adequate financial resources to fully implement closure.**			
Indicator 12.2.1.1.	**Closure cost estimations are contained in the closure plan.**			
Status:			**MET**	

The target specifies that cost estimates for the following items have to be considered in mine closure plans and the necessary financial resources must be placed in an independent fund:

[114] Consultation with team from Intergovernmental Forum on Mining, Minerals Metals and Sustainable Development, MME, NUST and Environmental Compliance Consultants developing the Mining Policy Framework, February 2018

[115] MET workshop on revised EMA, EIA and SEA regulations, Windhoek, February 2018

- employee costs (retrenchment provision, new employment opportunities, re-training costs);
- social aspects (sustainability of associated communities), exit strategy (that is, the process by which mines cease to support initiatives), social transition (that is, communities receiving support for transition to new economic activities);
- demolition and rehabilitation costs (infrastructure break-down, salvage and/or disposal at the site or transition to end uses), ecosystem rehabilitation costs of the site;
- post closure monitoring and maintenance; and
- project management (administration and management costs during the decommissioning period)

Indicator 12.2.1.2.	**Financial sureties are available.**			
Data Source	**SEMP Office/CoM/MME**			
Status:			**MET**	

Closure cost estimates are contained in the closure plans of operating mines and include the aspects listed above as shown in Table 38. Financial sureties to be placed in an independent fund will be addressed in the revised Minerals Act or associated regulations. As Swakop Uranium's mine closure plan was still being developed in 2017, the information in the closure-related tables was based on the EMP commitments. Considerations for the outstanding items, e.g. financial sureties are being assessed.

Table 38: Feedback Regarding Compliance with Closure Cost Provisions

Closure financing requirements	AREVA Namibia	Bannerman	Langer Heinrich	Rössing Uranium	Swakop Uranium
Includes employee costs	Yes	Yes	Yes	Yes	Yes
Social aspects, exit strategy	Yes	Yes	Yes	Yes	No*
Demolition and rehabilitation costs	Yes	Yes	Yes	Yes	Yes
Post-closure monitoring and maintenance	Yes	Yes	Yes	Yes	Yes
Project management	Yes	Yes	Yes	Yes	Yes
Closure cost estimations contained in the plan	Yes	Yes	Yes	Yes	Yes
Financial sureties are available	Yes	Yes	Yes	Yes	N/A*

*Closure plan being developed

Exploration companies are not required to comply with these two indicators (Bannerman Mining Resources, Marenica Energy, Reptile Mineral Resources and Exploration), but Bannerman have provided information to indicate the status of their plans.

Motivation of status: The operating mines had closure cost estimations in their plans in 2017. Langer Heinrich and Rössing Uranium provided financial sureties as per current practice, while Swakop Uranium was still busy completed the financial aspects of the closure plan. For the year under review the two indicators could be regarded as **MET**, provided that Swakop Uranium's financial commitments are addressed in 2018.

Desired Outcome 12.3.	**The Government has appropriate mechanisms in place to approve mine closure plans, financial instruments chosen for implementation and to effect relinquishment back to the state.**
Target 12.3.1.	**Adequate regulations applicable to mine closure are contained in the relevant legislation.**
Indicator 12.3.1.1.	**Mine closure regulations are adequate to govern:** • **review and approval of mine closure plans;** • **financial guarantees and sureties;** • **implementation review,** • **Relinquishment and transfer of liabilities to the subsequent land owner.**
Data Source	**SEMP Office/CoM/MME/Ministry of Environment and Tourism**
Status:	**IN PROGRESS**

As mentioned above, Government is in the process of updating the Minerals Act to establish adequate governance of mine closure. The proposed closure legislation is expected to cover the review and approval of mine closure plans, financial guarantees and sureties, implementation review, as well as relinquishment and transfer of liabilities to the subsequent land owner. MME as the responsible authority will have to ensure that they have the required capacity and expertise to review closure plans.

Motivation of status: The indicator was **IN PROGRESS** because Government is working on mine closure legislation.

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Summary of performance: EQO 12

Total no. indicators assessed 4				
	NOT MET	**IN PROGRESS**	**MET**	**EXCEEDED**
Number of indicators in class	0	1	3	0
Percent of indicators in class	0%	25%	75%	0%

Overall performance: The first three indicators were **MET** (75%) because the operating mines had closure plans that were consistent with the Namibian Mine Closure Framework and IAEA guidelines, as well as closure cost estimations and financial sureties. The fourth indicator requires adequate mine closure regulations to govern the review and approval of mine closure plans at all stages of the closure and relinquishment process. It was rated **IN PROGRESS** (25%) because Government has started working on the relevant legislation. The overall EQO performance was the same as in the previous SEMP report.

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SUMMARY OF RESULTS

EQO 1

Indicators of Socioeconomic Development are related to the payment of royalties and taxes, local procurement and EPZ status for processing companies. The four indicators have all been **MET** in 2017 (100%).

EQO 2

The only indicator of Employment has always been **MET** (100%) because the majority of the permanent workers and contractors at uranium mines are Namibian citizens and companies receive AA compliance certificates.

EQO 3

The infrastructure EQO covers housing, transportation including roads, railways and harbour, electricity supply and renewable energy, as well as waste management and recycling. The two housing indicators continued to be **MET** because mining companies do not intend to establish on-site hostels or mine-only townships. Four indicators referring to road condition and maintenance were **MET** and two were **IN PROGRESS**, while one (safe traffic on the B2 road) was **NOT MET**. The indicator for the reduction of heavy traffic on the road between Swakopmund and Walvis Bay was **NOT APPLICABLE**. The indicator of rail use for bulk goods was **MET**, while Namport's three indicators were **MET** or **EXCEEDED**. The indicators concerning the quantity and quality of electricity supply to the region and the implementation of renewable energy projects at mines were mostly **MET**, only the indicator on the health impact of local electricity generation was **IN PROGRESS**. Ten waste management indicators were **MET** and five were **IN PROGRESS**. Among these, all four indicators that check the mines' compliance with regulatory requirements for the management of mineral waste were **MET**.

EQO 4

Seven of the eight indicators in the Water EQO were **MET** (87.5%) in 2017, while one indicator related to the continuous availability of desalinated water during sulphur outbreaks was **IN PROGRESS** (12.5%). Contrary to fears expressed during the SEA process uranium mining did not compromise the water quality or lower the water table in the rivers. The water tariff for domestic users did not yet increase to the level required to cover the cost of desalinated water.

EQO 5

The Air Quality performance did not change from the 2016 report as all three indicators continued to be **MET** (100%). Progress towards the long-awaited regional air quality standard was made in the course of the advanced air quality study that runs from October 2016 to February 2019. The consultants have set up a new regional monitoring system that will be handed over to GRN after the study.

EQO 6

Two Health indicators were **MET** (25%), i.e. the radiation dose to workers at mines did not exceed the legal limit and the incidence of occupational diseases did not increase. The three indicators **IN PROGRESS** (37.5%) are related to public dose assessments that will be re-assessed as part of the advanced air quality study and the Rössing Uranium epidemiological study. The three indicators measuring the ratio of healthcare professionals and facilities per number of population were regarded as **NOT MET** (37.5%) because the MHSS strategic plan for the next five years does not make provision for the required numbers in the year 2020.

EQO 7

The indicator gauging tourists' experience of the Namib was again **EXCEEDED** (20%) and three indicators were **MET** (60%), showing that tourism operators and mining industry are able to coexist in the Central Namib. Even though the indicator concerning the protection of tourism hotspot was **NOT MET** (20%), it seems that conflict between the need for public access and mining has so far been avoided and uranium mining did not prevent the public from visiting the usually accessible areas in the Central Namib for personal recreation. Indicators related to EIAs and issuing of licences were **NOT APPLICABLE** because these activities did not take place in 2017.

EQO 8

Nine of the Ecological Integrity (EQO 8) indicators were **MET** in 2017 (64%). It was confirmed that mines use the mitigation hierarchy to actively avoid, mitigate or restore the affected environment, specifically sensitive areas within the mining licence areas. Mining companies have also partnered with conservation organisations and supported additional conservation projects, as far as currently possible. The Ministry of Environment and Tourism has improved its visibility in the parks with the support of concerned stakeholders and the impact of mines on the ephemeral rivers was monitored. Three indicators related to secondary impacts in protected areas and studies being conducted to understand the impact of water abstraction on the riverine vegetation and to develop a regular monitoring programme for riverine vegetation and wetlands are still **IN PROGRESS** (21%). The two indicators concerning the protection of important biodiversity areas and the implementation of biodiversity offsets were **NOT MET** (14%) due to the absence of enabling legislation. Six indicators were **NOT APPLICABLE**.

EQO 9

Six of seven education indicators were **NOT MET** (86%), only the indicator requiring an increase in the number of graduates from tertiary and vocational training institutions was **MET** (14%). Four indicators that were **NOT MET** concerned the performance of schools in the Erongo Region in terms of improved Grade 10 and 12 examination results and teacher to learner ratios. The other two indicators revealed that some operating mines failed to spend 3% of total wage cost on training and did not allocate 10% more bursary holders than work-permit holders.

EQO 10

The six EQO 10 indicators that were **MET** (60%) relate to the correct EIA process being followed, international checks on the uranium industry's performance, the availability of monitoring results in annual SEMP reports, action taken to address EMP non-compliance and no published evidence of unethical conduct. Three indicators were **IN PROGRESS** (30%) because many GRN agencies postponed their annual inspections at active mines or three-yearly inspections at closed mines and the regulations that will enable the Ministry of Environment & Tourism to appoint honorary conservation officers and to levy fines were still pending. The indicator regarding corruption in the allocation of mining licences was **NOT MET** (10%). Six indicators were **NOT APPLICABLE** because MME did not issue new licences for uranium prospecting or mining in red or yellow flag areas and MET did not issue any compliance orders.

EQO 11

There was significant progress in archaeological research during the last two years, leading to two indicators being **MET** (100%). The development of diachronic models to determine the effects of climatic and environmental changes and to guide decisions about development in the desert is expected to proceed in due course; in the meantime these indicators will be rated **NOT APPLICABLE**. The indicators about the conservation of archaeological remains were **NOT APPLICABLE** either since no archaeological assessments for new or existing mines were carried out in 2017.

EQO 12

The first three indicators were **MET** (75%) because the operating mines had closure plans that were consistent with the Namibian Mine Closure Framework and IAEA guidelines, as well as closure cost estimations and financial sureties. The fourth indicator requires adequate mine closure regulations to govern the review and approval of mine closure plans at all stages of the closure and relinquishment process. It was rated **IN PROGRESS** (25%) because Government has started working on the relevant legislation.

The overall performance of the SEMP EQOs in 2017 showed an increase in the number of indicators being **MET** (54%) compared to the previous year, while two indicators were **EXCEEDED** (2%). The percentage of indicators that were **NOT MET** increased to 12%, while the indicators **IN PROGRESS** dropped to 16% (Table 39 and Figure 53). In 2017, 21 indicators were rated **NOT APPLICABLE** because the relevant activity did not take place (17%).

Table 39: EQO Performance in 2017 Compared to Previous Years

Status (%)	NOT MET	IN PROGRESS	MET	EXCEEDED
2017	14 (12%)	19 (16%)	65 (54%)	2 (2%)
2016	9 (7%)	23 (19%)	57 (47%)	3 (2%)
2015	3 (3%)	34 (34%)	61 (60%)	3 (3%)
2014	8 (7%)	40 (33%)	71 (58%)	3 (2%)
2013	12 (10%)	36 (30%)	70 (59%)	1 (1%)
2012	21 (18%)	37 (32%)	57 (49%)	1 (1%)
2011	14 (11%)	44 (36%)	64 (52%)	1 (1%)

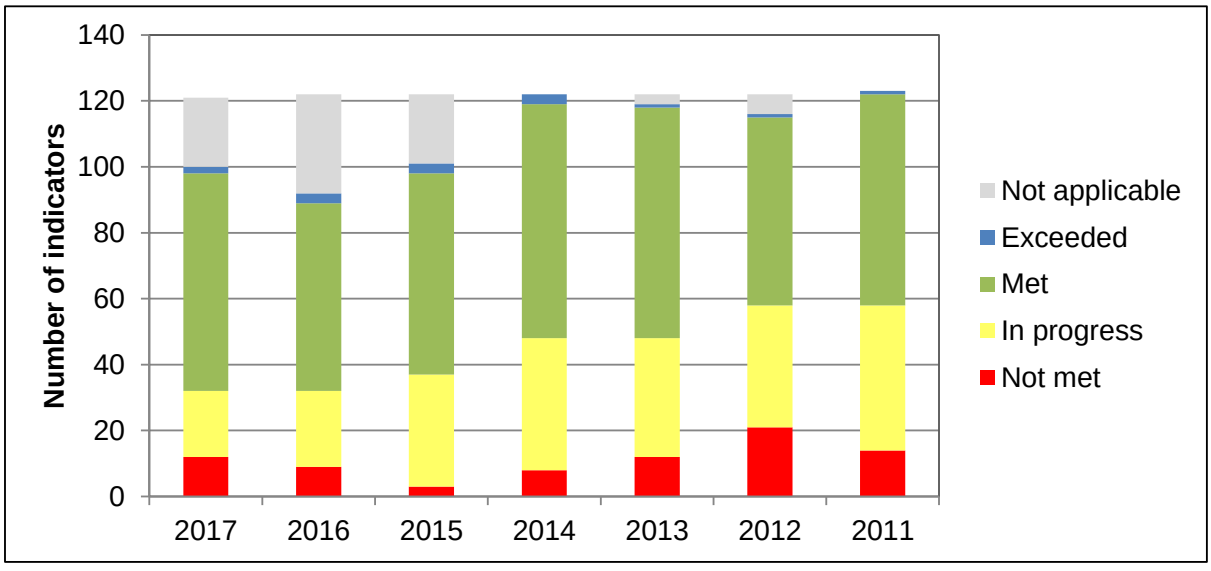

Figure 53: EQO Performance Trends over Time

The number of indicators that were **MET** and those that were **NOT MET** has increased in 2017 compared to 2016, while there were fewer indicators **IN PROGRESS** or **NOT APPLICABLE**. This indicates a more stringent approach to the assessment which tried to avoid calling an indicator **IN PROGRESS** when the situation was unclear or no real progress could be shown. The persistent relatively high number of outstanding issues suggests that more resources will be required if the desired outcome of the SEMP is to be achieved.

Figure 54 displays the performance for each EQO, which can be summarised as follows:

- The Socioeconomic Development (EQO 1), Employment (EQO 2) and Air Quality (EQO 6) objectives and the two applicable indicators in Heritage (EQO 11) were all **MET**.
- The objectives for Water (EQO 4) and Mine Closure (EQO 12) were mostly **MET** with a small percentage **IN PROGRESS**.
- Mixed results ranging from **MET** to **NOT MET** were obtained in the following EQOs: Infrastructure (EQO 3), Effect on Tourism (EQO 7), Ecological Integrity (EQO 8) and Governance (EQO 10).
- In Health (EQO 6) and Education (EQO 9) the number of indicators **NOT MET** or **IN PROGRESS** was higher than the ones that were **MET**.
- Other indicators that were **NOT MET** relate to the availability of safety of the B2 road in EQO 3 and the protection of sensitive areas in EQOs 7 and 8, as well as the implementation of biodiversity offsets in EQO 8. One EQO 10 indicator was **NOT MET** because of possible corruption in the allocation of a mining licence.
- Two indicators were **EXCEEDED**, one in EQO 3 concerning Namport's infrastructure and one in EQO 7 regarding tourists' expectations of their visual experience in the Central Namib.

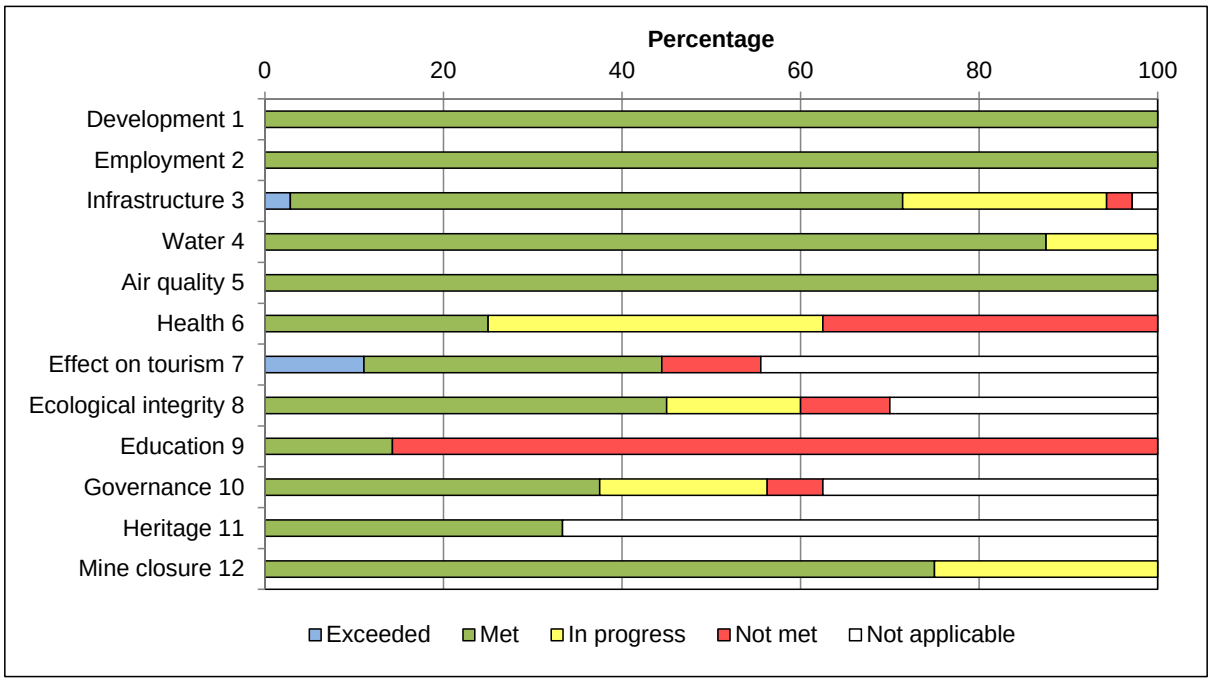

Figure 54: Performance per EQO in 2017

ACTIONS ARISING FROM THIS REVIEW

The implementation of EQO targets is essential to ensure that the region is well positioned for future uranium mining projects. Table 40 summarises the most important actions to address the shortcomings identified in this report. Responsible agencies should take note that the review covers the year 2017 and the report was completed at the end of 2018.

Table 40: SEMP Action Plan

Target / Indicator	Deficiency	Actions	Agency
3.2.1.1: Surfaced roads are adequate and safe for traffic frequency	Traffic on the B2 has increased to the extent that the road has become unsafe	• Upgrade the road to double lanes or create passing lanes at least up to Arandis	Roads Authority
3.2.1.2: Unsurfaced roads carrying >250 vehicles per day need to be tarred	Tourists use the C14 (MR 36) which is in poor condition to/from Sossusvlei	• Due to economic importance of tourism the C14 should be upgraded urgently	Roads Authority
3.2.1.4: Road markings and signs are present and in good condition	Visibility on the B2 at night should be improved	• Install cat's eyes for better visibility in the fog zone	Roads Authority
3.3.1: Most bulk goods are transported by rail	Bulk goods such as fuel are transported by road	• Upgrade the railway line to be keep bulk freight off the roads	Transnamib
3.5.1.5: Electricity provision does not compromise human health	Study carried out at Van Eck emissions did not come to firm conclusions	• Determine if power station emissions comply with air quality guidelines	NamPower
3.6.1.3: All new waste sites undergo an EIA prior to construction and receive a licence to operate	Municipalities completed EIAs for new sites, licencing in progress	• Comply with conditions to obtain environmental clearance certificates	Swakop and Walvis Bay Municip.
3.7.1.1: Waste site managers are adequately trained	Contractors at Walvis Bay were not fully trained	• Train newly appointed contractors	WB Municipality
3.7.1.2: Site manifests which record non-hazardous waste volumes and origins are kept	Not all the required records are kept	• Swakopmund waste site needs a weighbridge • Improve record-keeping	Swakop, WB Municipalities
3.7.1.4: Water and air quality monitoring data at waste sites show no non-compliance readings	Air quality is monitored at Swakopmund and Walvis Bay, but not water quality	• Monitor water quality to see if there is hydrocarbon or other hazardous pollution	Swakop, WB Municipalities
4.3.1.2: Desalinated water meets mine demand	Water supply disruptions due to sulphur outbreaks in the sea	• Upgrade Erongo desalination plant to handle H_2S outbreaks	NUA (Orano)
6.1.1.1: Public dose assessments produced by each new mine project	Cumulative impact of other operating mines has not been considered	• Impact will be determined in the advanced air quality study that is	MME

Target / Indicator	Deficiency	Actions	Agency
include the cumulative impact of other operating mines		still in progress	
6.1.3.2: Measured change in the incidence rate of diseases scientifically attributed to radiation amongst members of the public and uranium mine workers	Incidence rate of diseases scientifically attributed to radiation in the Erongo Region is unknown	• Rössing Uranium commissioned an independent study to determine if there is an excess, work-related cancer risk for uranium miners	NUA (RUL)
6.2.1: An increase in qualified health workers available to all in the Erongo Region to 2.5 per 1000 of the population by 2020	Number of healthcare professionals in the region is below the envisaged target ratios	• Employ the number of healthcare professionals identified in the SEA	MHSS
6.2.2: An increase in registered healthcare facilities in Erongo, reaching 2.5 acute care beds per 1000 population and 0.5 chronic care beds per 1000 population by 2020	Number of healthcare facilities in the region is below the envisaged targets	• Construct additional healthcare facilities as identified in the SEA	MHSS
6.2.3: An increase in ambulances in Erongo, reaching 1 per 20,000 by 2020	Number of ambulances in the region is below target	• Get additional ambulances (and qualified drivers)	MHSS
7.1.1.1: Areas of importance for recreation that are not yet alienated by mining or prospecting are declared 'red flag' for prospecting or mining	The Walvis-Swakop dunes, Messum Crater, Klein Spitzkoppe, Swakop and Khan rivers, Welwitschia Drive and Park campsites are not declared 'red flag'	• Ensure that these areas remain accessible for tourism and recreation	MME and MET
8.1.1.1: Important biodiversity areas [red or yellow flag areas] are taken into consideration when adjudicating prospecting and mining applications	Some red and yellow flag areas are not included in the Policy on Prospecting and Mining in Protected Areas	• Consider the status of these areas before granting mining or exploration licences	MME
8.2.1.2: Mining companies commit to sustainable offset initiatives to ensure 'no net loss' to biodiversity as a result of their operations	Implementation of offsets hampered by lack of procedure and regulations	• Include offsets in revised Environmental Management Act and regulations	NUA
8.4.1.1: Off-road driving, poaching, illegal camping, littering by mine personnel, are explicitly prevented by mining and explora-	MET reported transgressions but could not say if they were committed by mining personnel or members of the public	• Report offenders to NUA so that mines can take action • Continue to prevent and monitor secondary im-	MET NUA

Target / Indicator	Deficiency	Actions	Agency
tion personnel and their contractors		pacts	
8.5.1.1: Regular monitoring of indicator species in relevant ephemeral rivers is in place to detect any impacts on wetlands, phreatophytes and riparian vegetation	Monitoring system not yet in place, but studies ongoing	• Identify indicators, design and implement a monitoring system	NERMU
8.5.2.1: No unusual loss of wetland and riparian vegetation	This will form part of the monitoring system mentioned above	• Identify indicators, design and implement a monitoring system	NERMU
9.1.1.1: Erongo Region Grade 10 and 12 results improve over time compared to other regions	Erongo was ranked 7th or 8th of 14 regions in Grade 12 results	• Improve performance of teachers and learners in the region	MEAC
9.1.1.2: Teacher to learner ratio at schools in Arandis, Swakopmund and Walvis Bay is better than the national average	Erongo Region's ratio of 26 was above the national average of 25	• Employ more teachers to achieve a ratio of <25 in the Erongo Region	MEAC
9.1.1.4: Region improves performance in reading and mathematics	Standardised Achievement Tests (SAT) not done in 2017, therefore no data	• Carry out SAT to measure performance	MEAC
9.2.1.2: Each mine has or funds a skills development programme for employees (3% of wage cost)	One company exceeded the target, while others failed to supply data or did not meet the target	• Allocate more funding to skills development and provide data to SEMP	NUA
9.2.1.3: Each mine has 10% more bursary holders than work-permit holders	One company exceeded the target, while another failed to meet it	• Allocate more bursaries or reduce number of work-permit holders	NUA
10.2.1.2: No evidence of corruption in the allocation of mining licences	No information provided about decision on new mining licence in 2017	• Follow due process when allocating new mining licences	MME
10.3.1.1: GRN agencies inspect active mines at least once per annum, and closed mines at least once every 3 years	Not all agencies inspected each of the mines as required in 2017	• Inspect operating mines every year • Inspect closed mines every 3 years	MME MET MAWF MHSS
10.3.1.2: Honorary conservators are appointed by MET to assist with monitoring, including of unauthorized secondary activities such as off-road driving, poaching and littering	No honorary conservator officers appointed to date, though provision is made in Parks and Wildlife Bill	• Promulgate Parks and Wildlife Bill • Create the necessary regulations	MET

Target / Indicator	Deficiency	Actions	Agency
10.4.1.3: Fines are issued for non-compliance	Currently no legal basis for the issuing of fines	• Amend EMA and create regulations for fines	MET
12.3.1.1: Mine closure regulations are adequate to govern: Review and approval of mine closure plans; financial guarantees; implementation review; relinquishment and transfer of liabilities to the subsequent land owner	Namibia does not have mine closure regulations, only a Mine Closure Framework proposed by the industry	• Update the Minerals Policy and Act • Create the necessary regulations	MME

CONCLUSIONS

The SEMP is a living document that has to be amended to keep up with development. Some goals, targets and indicators have been changed in the seventh annual SEMP report to make the wording clearer or more appropriate. It has become clear over the years that many indicators were formulated under the assumption that the “uranium rush” that triggered the SEA would lead to the development of quite a few new mines. The current mining scenario, which closely resembles the base case, was not foreseen in the SEA. There are only two operating mines, Rössing and Husab, while Langer Heinrich Mine was mothballed in 2018. All the other projects are still awaiting improved market conditions.

Seeing that the uranium rush was revealed as a short-lived phenomenon, the impact on the environment and the demand for social services in the Erongo Region will evidently not continue rising as a result of uranium mining. The SEMP Steering Committee has therefore raised the question whether it was worthwhile to keep on evaluating all indicators on an annual basis. It was suggested that ”slow-moving” EQOs like infrastructure, health and education could be assessed every second year. Issues of public concern such as economic development, employment, tourism and ecological impact, as well as air and water quality would still be monitored and updated annually.

This would maintain the function of the SEMP as a long-term monitoring and decision-making tool through which potential impacts are highlighted so that measures can be introduced to avoid unnecessary impacts or mitigate unavoidable impacts. A continuing aim of the SEMP process is to increase the commitment of key government institutions, the uranium industry and NGOs to undertake whatever actions will take the Erongo Region towards the desired future state where communities and industry are able to co-exist in harmony.

The SEMP Office issued a brochure in 2018 to inform the public and stakeholders such as government and parastatal institutions about the objectives of the SEMP and the importance of their contributions. Some stakeholders involved in data collection or monitoring and the implementation of particular targets were visited during the data collection process. Personal interaction was found to be most effective in building productive relationships. The SEMP Office hopes to expand on this stakeholder engagement process in future.

In view of the cyclical nature of commodity markets it is expected that the demand for uranium will increase in future. The implementation of EQO targets according to the action plan in this report, as well as the ongoing monitoring and reporting on achievements and shortcomings is essential to ensure that the Erongo Region is well positioned for future uranium mining projects.

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