Report No: 4560/402239

SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT: PROPOSED EXPANSION PROJECT FOR RÖSSING URANIUM MINE IN NAMIBIA: PHASE 1 ~ ACID PLANT, ORE SORTER AND SK4 PIT

FINAL SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

February 2008

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ABBREVIATIONS

±	Approximately / "plus / minus"
° C	Degree Celsius
µg/m^3	Micrograms per cubic metre
µSv/a	Microsieverts per annum : µ = a metric prefix meaning 10^{-6} (one millionth); Sv = Sievert (an SI unit used for measuring the effective (or "equivalent") dose of radiation received by a human or some other living organism.) per a = an international symbol for year
ARD	Acid rock drainage
As	Arsenic
cm	Centimetre
CO	Carbon Monoxide
CSIR	South African Council for Scientific & Industrial Research
dB	Decibel
dB(A)	Ambient decibels
DEA	Directorate of Environmental Affairs (MET)
DRFN	Desert Research Foundation of Namibia
EAP	Environment Assessment Policy of 1994
EC	European Community
EEAN	Environmental Evaluation Associates of Namibia
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
F	Fluorine
FPR	Final Product Recovery
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GJ	Gigajoule: Symbol of measurement for energy use
Grindrod	Grindrod Limited : Lessee to Namport for the Bulk Terminal facility in the Port of Walvis Bay
GJ/a	Gigajoules per annum
H_2S	Hydrogen Sulphide
Gov of SA	Government of South Africa
H_2SO_4	Sulphuric Acid
ha	Hectare
HCl	Hydrochloric Acid
Hg	Mercury
HIA	Heritage Impact Assessment
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
I&APs	Interested and Affected Parties
IAEA	International Atomic Energy Agency

ICRP	International Council for Radiological Protection
ISO 14 001 EMS	International Standards Organisation 14001 Environmental Management System
IUCN	International Union for the Conservation of Nature
$kg.t^{-1}$	Kilograms per tonne
kg/t	Kilograms per tonne
km	Kilometre
km/h	Kilometres per hour
kPa	Kilopascal
kt/a	Kilotonnes per annum
kV	Kilovolts
kWh	Kilowatt hour
m	Metre
m^2	Square metre
m^3	Cubic metre
m^3/day	Cubic metres per day
m^3/h	Cubic metres per hour
mamsl	Metres above mean sea level
Med	Medium
MET	Ministry of Environment and Tourism (national environmental authority)
MET:DEA	Ministry of Environment and Tourism's Directorate of Environmental Affairs
mg	Milligram
mg/m^2	Milligrams per square metre
$mg.Nm^{-3}$	Milligrams per normal cubic metre
mm	Millimetre
Mm^3	Million cubic metres
MME	Ministry of Mines and Energy
mSv/a	Millisieverts per annum
Mt	Megatonne : A metric unit of mass or weight equal to one million metric tons
MW	Megawatt
N$	Namibian Dollar
NECSA	National Energy Council of South Africa
Nm^3	Normal Cubic Meter (a unit of mass for gases equal to the mass of 1 cubic meter at a pressure of 1 atmosphere and at a standard temperature, often 0 °C or 20 °C
NOx	Nitrogen Oxides
O_2	Oxygen
PID	Public Information Document
PM10	Particulate Matter: The 10% of total particulate matter suspended in earth's atmosphere that is caused by human activity.
ppm	Parts per million
PPP	Public Participation Process

PRU	Physiographic Rating Units
Rio Tinto T&I	Rio Tinto Technology & Innovation
RU	Rössing Uranium
S	Sulphur
SAIEA	Southern African Institute for Environmental Assessment
SANS	South African National Standards
SAPP	Southern African Power Pool
Se	Selenium
SEIA	Social and Environmental Impact Assessment
SEIR	Social and Environmental Impact Report
SEMP	Social and Environmental Management Plan
SO_2	Sulphur Dioxide
SO_3	Sulphur Trioxide
Sv	Sievert
t	Tonne
t/d	Tonnes per day
Taxa	Plural of “Taxon”
Taxon	Taxonomic Unit: A name designating an organism or group of organisms.
t CO_2-e/a	Tonnes of Carbon Dioxide equivalent per annum
ToR	Terms of Reference
tpd	Tonnes per day
U_3O_8	Uranium Oxide
US$	American Dollar
V_2O_5	Vanadium Pentoxide
V Low	Very low
WHO	World Health Organisation

UPDATE SUMMARY

FINAL SOCIAL AND ENVIRONMENTAL IMPACT REPORT: RÖSSING URANIUM'S PROPOSED EXPANSION PROJECT, PHASE 1 ASSESSMENT: February 2008

This Update Summary describes the process followed since the Phase 1 Draft Social and Environmental Impact Assessment (SEIA) Report for Rössing Uranium's proposed expansion project was made available to interested and affected parties (I&APs), stakeholders, authorities and review consultants for their comment. It also indicates how the finalisation of the SEIA Report has responded to public and review input and outlines the way forward in the environmental decision-making process. The proposed developments in question are an acid plant, an ore sorter plant and mining of the SK4 area.

PROCESS DURING THE SEIA STAGE

The public participation actions undertaken during the SEIA Stage of the process comprised the following:

- Engagement with I&APs who had expressed an interest in the Scoping Stage participation process;
- Presentation of the findings of the Draft SEIA Report;
- Registration of any additional I&APs;
- Notification and response to questions and/ or issues of concern; and
- Investigation of issues at greater depth where the need for this was indicated.

While the SEIA Stage of the process was underway, the public participation practitioner initiated meetings with identified stakeholders during November 2007, and RU personnel met with four concerned farmers during December 2007.

All registered I&APs were informed of the availability of the Draft SEIA Report, the period for review, the public meetings being held and the venues where the report would be available. Three public participation meetings were held to present the findings of the Draft SEIA Report.

The comments received during the commenting period for the Draft SEIA Report, as well as the Record of Stakeholder Issues compiled in response to the comments, are presented as an annexure to this finalised SEIA Report.

This finalised SEIA Report is now to be submitted to the environmental authorities for decision-making and all registered I&APs and stakeholders will be informed of their decision once it is made available.

UPDATING OF THE DRAFT SEIA REPORT

Updating of the Draft SEIA Report to this finalised version has entailed the following:

- Amending typographical and other insignificant errors that appeared in the Draft SEIA Report and indicating these and other changes in the main body of this report by underlining;
- Updating the public participation process to reflect the latest round of public engagement (also underlined);
- Undertaking independent reviews of the Draft SEIA Report, reflecting these in an annexure to this finalised SEIA Report and undertaking the changes required to the report (also underlined);
- Confirming the recommendations regarding the preferred alternatives and mitigation measures with Rössing Uranium as the proponent; and
- Appending the following additional or outstanding annexures:
  - Annexure D2: Radiological Dose Assessment Report
  - Annexure E: Risk Assessment of the Sulphuric Acid Plant
  - Annexure I: Noise Impact Assessment
  - Annexure L: Record of Stakeholder Issues
  - Annexure M: Examples of public notice and newspaper advertisements
  - Annexure N: Independent external and internal reviews

The Draft SEIA Report has been updated to this Final SEIA Report by means of the inclusion of this Update Summary, the incorporation of the above changes in the text of the report, as well as the additional annexures as listed. Significant amendments to the body of the report are indicated by means of underlining in the final version, to enable readers to track the changes easily.

THE WAY FORWARD

This finalised SEIA Report is to be submitted to the Ministry of Environment and Tourism's Directorate of Environmental Affairs (MET:DEA) for their consideration of issuing a clearance for Rössing Uranium's proposed developments.

Once they have considered the documents and are satisfied that they provide sufficient information to make an informed decision, MET:DEA will determine the environmental acceptability of the recommended project actions and mitigation measures. Should the proposed activity be approved, they will issue a clearance, together with any conditions of approval relative to the decision.

Following the issuing of the clearance, MET:DEA's decision will be communicated to all registered I&APs and stakeholders.

We would like to thank all those who have participated in Rössing Uranium's Phase 1 SEIA process for the proposed acid plant, ore sorter plant and mining of SK4.

29 February 2008

EXECUTIVE SUMMARY

FINAL SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT: PROPOSED EXPANSION PROJECT FOR RÖSSING URANIUM MINE IN NAMIBIA: PHASE 1 ~ ACID PLANT, ORE SORTER AND SK4 PIT

BACKGROUND

Rössing Uranium (RU) has operated an open pit uranium mine in the Erongo Region of Namibia since 1976. As a result of an increase in uranium prices on the international market in recent years, RU is able to consider the possible financial benefit from an expansion of its operations. The anticipated closure date of the Rössing uranium mine is consequently being re-evaluated in terms of overall feasibility, i.e. including social and environmental criteria.

The maximum extent of the envisaged expansion would entail the opening of two new pits, with new disposal areas for waste rock, new or expanded processing plants, additional tailings dam capacity, and an increase in staff numbers and facilities. In terms of the Namibian Constitution and related environmental legislation, in particular the Environmental Assessment Policy and the Minerals Act, the proposed expansion activity would require authorisation from the responsible authority, the Ministry of Environment and Tourism's Directorate of Environmental Affairs (MET:DEA), before it can be undertaken. A Social and Environmental Impact Assessment (SEIA) has thus been commissioned by RU for their proposed expansion project.

The Scoping stage of the assessment was undertaken towards the end of 2007 and resulted in a Scoping Report that was released in November 2007. The Scoping Report described the possible social and environmental impacts that were identified, as well as those aspects recommended for further study. A number of specialist studies have thus been undertaken to properly understand the potentially most significant impacts of the proposed developments and to ensure an acceptable level of confidence in the assessment of such impacts. The following aspects have undergone specialist studies and their terms of reference appeared in the Scoping Report of November 2007:

- Socio-economic;
- Air quality;
- Risk (human health);
- Visual
- Radioactivity and public dose;
- Biodiversity;
- Archaeology (i.e. heritage);
- Water resources;
- Noise and vibration; and
- Energy use.

A draft version of this SEIA Report was released for review and comment by interested and affected parties (I&APs), stakeholders and authorities. Comments received have been responded to and concerns raised have been appropriately dealt with and reflected in this finalised SEIA Report. The report is designed to provide sufficient and reliable information for MET:DEA to make an informed decision on whether or not RU's proposed expansion project is acceptable from a social and environmental perspective and it comprises the following:

- An outline of the legal and policy framework regarding the environment, within which RU operates and this assessment is undertaken;
- A description of the proposed developments, their alternatives and potential impacts;
- A description and the outcome of the public participation process undertaken to date, the outcomes of comments received and the way forward with this process;
- A description of the assessment methodology applied;
- Most importantly, an assessment of the significance and possible mitigation of the potential impacts that were identified during the Scoping stage of the SEIA process;
- A Social and Environmental Management Plan to provide RU with the means of ensuring that their proposed development can be constructed and operated in a socially and environmentally responsible manner.

PROJECT DESCRIPTION AND IDENTIFICATION OF ALTERNATIVES AND POTENTIAL IMPACTS

RU's proposed expansion project comprises two phases of assessment. The subject of the present SEIA Report is Phase 1, comprising the following three components (see overview map on page xiii):

Acid plant:

- A sulphuric acid production plant to be built at the Rössing mine site;
- The existing on-site acid storage facilities to be upgraded and utilised to store the acid produced;
- Rail transport by TransNamib through Walvis Bay and Swakopmund of elemental sulphur feedstock for the acid plant; and
- The sulphur offloading, storage and handling facilities at Rössing mine to be installed.

Ore sorter plant:

- The system for ore reclaiming from the coarse ore stockpile;
- A pre-screening plant;
- The production ore sorting plant, comprising four screening units and two ore sorter clusters;
- The handling of rejected rock;
- Storage and transport of rejected rock to the nominated waste disposal area; and
- The tie-in for all equipment into the current operation.

Mining of SK4 ore body:

- Providing access to the ore body;

- The provision of water for drilling and dust suppression;
- The commissioning work to prepare for production mining, i.e. the creation of drilling platforms and excavation of two 15 m benches;
- Drilling, blasting, loading and haulage of ore;
- The transport of waste material to the *Waste 7* site; and
- A haulage road to transport the ore to the primary ore crusher.

The remaining expansion project components will be dealt with as another SEIA in 2008, referred to as Phase 2. I&APs registered for the present Phase 1 of the SEIA will be kept informed once the Phase 2 process is launched. In brief, the Phase 2 project components comprise the following:

- Extension of the current mining activities in the existing SJ pit;
- New mining activity in the larger SK area;
- Increased tailings disposal capacity;
- Increased waste rock disposal capacity;
- Establishing an acid heap leaching facility; and
- Sulphur handling in the Port of Walvis Bay.

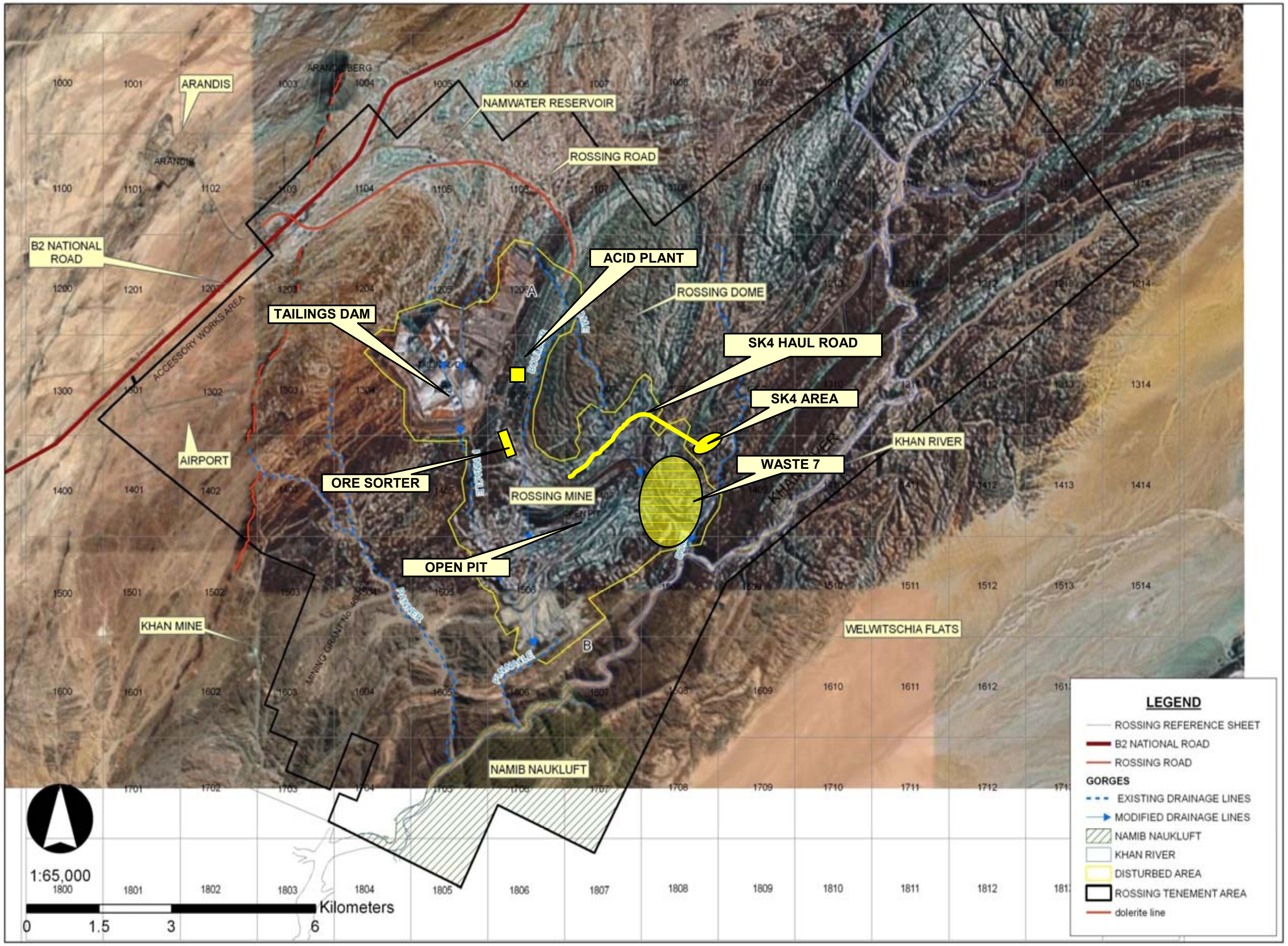
The **identification and consideration of alternatives** is recognised as good practice in environmental assessment procedures globally and the Scoping stage included the identification and screening of alternatives. The selected alternatives that have been assessed in terms of their potential impacts on the socio-economic and biophysical environment during the present SEIA Report stage are:

- A suitable disposal site for reject rock from the ore sorter plant, either at a new site immediately to the west of the plant or on existing waste rock disposal sites;
- The location of a construction camp at one of three alternatives, namely in Arandis or Swakopmund, or on farmland in the vicinity of Rössing mine;
- Housing additional RU employees, either in Arandis or Swakopmund / Walvis Bay; and
- Additional schooling for RU employees by means of extra classrooms at existing schools, a new school built in collaboration with government or with other mining companies, or a hostel in Arandis.

As far as **identified impacts** are concerned, the Scoping Report records both construction phase impacts and operational phase impacts. It also differentiates between common socio-economic impacts and impacts that are specific to the three project components. The entire array of issues identified for assessment in the present SEIA comprises the following:

Common socio-economic issues during the operational phase

- Economic sustainability of Arandis;
- Permanent employment creation;
- Public health and safety;
- Housing and accommodation;



Overview of proposed project components (source: modified from Visual Impact Assessment : VRMA, 2007)

- Local economies;
- Inward migration;
- Schooling; and
- Infrastructure.

Specific issues related to the three project components during the operational phase

- Air quality;
- Human health;
- Visual;
- Water resources;
- Noise and vibration;
- Waste rock disposal;
- Energy use; and
- Biodiversity.

Construction phase issues

- Generic construction impacts;
- Employment during construction; and
- Construction camp.

THE PUBLIC PARTICIPATION PROCESS

Engagement with the public and stakeholders interested in or affected by development proposals forms an integral component of the environmental assessment process. Thus, I&APs have an opportunity at various stages throughout the SEIA process to gain more knowledge about the proposed project, to provide input and to voice any issues of concern.

Stakeholders and I&APs had several opportunities to participate in the Scoping Stage of the present SEIA process and the useful inputs received are acknowledged. The following are the most noteworthy of the issues raised by I&APs to date and a comparison with the list of identified impacts in the previous section confirms that they were all subjected to assessment:

- Employment opportunities;
- Workplace health and safety concerns, including air and water pollution and noise;
- Housing implications;
- Services such as schools, medical care and water availability;
- Effects on the regional and local economy, including tourism;
- Negative social impacts from newcomers seeking work;
- Possible human and environmental threats from transporting, storing and processing sulphur and sulphuric acid, in and between Walvis Bay and the mine site;
- Possible dust, noise and vibration threats to humans and the environment from the SK4 mining area and dust and noise from the ore sorter plant, including waste rock management;
- Biodiversity implications, particularly in the SK4 mining area;
- Supply, storage, application, runoff and reuse of water, particularly in the SK4 mining area;

- Regional implications of bulk water supply;
- Visual impacts of the acid plant, ore sorter or SK4 mining activities; and
- Energy use.

The objectives of public participation are being maintained throughout this SEIA process. These are to provide information to the public, identify key issues and concerns at an early stage, respond to the issues and concerns raised, provide a review opportunity, and document the process properly.

All registered I&APs were informed of the availability of the draft version of this SEIA Report, the period for review, the public meetings being held and the venues where the report will be available. The findings of the Draft SEIA Report were presented at public participation meetings in Arandis, Swakopmund and Walvis Bay between 22 and 24 January 2008. At the same time, copies of the Draft SEIA Report were lodged for public viewing at the libraries in Swakopmund, Walvis Bay, Windhoek and Arandis. The report was also placed on RU's website. The public comment period for response to the Draft SEIA Report ended on 15 February 2008.

ASSESSMENT OF POTENTIAL IMPACTS AND POSSIBLE MITIGATION MEASURES

The methodology applied during this SEIA uses a tabulated rating system, where each impact is described according to its extent (spatial scale), magnitude (size or degree scale) and duration (time scale). These criteria are used to ascertain the significance of the impact, with and without mitigation. Once the significance of an impact has been determined, the probability of this impact occurring as well as the confidence in the assessment of the impact is determined. Lastly, the reversibility of the impact is estimated.

Challenges faced during the application of the methodology as described relate to the subjectivity in assigning significance to an impact and the consideration of cumulative impacts.

The table on the next page provides a summary of the significance of the social and environmental impacts associated with this proposed project. In recognising the extent of the information available at this stage of the project planning cycle, the confidence in the assessment undertaken is regarded as acceptable for informed decision making.

CONCLUSIONS AND RECOMMENDATIONS

As described above, the proposed project consists of the establishment of a sulphuric acid production plant, an ore sorter plant and the mining of the SK4 ore body. The most significant negative impacts, i.e. those of a ***medium or high negative rating, without mitigation*** are indicated in red and orange respectively in the table overleaf. However, it can be seen that the significance of these impacts reduce considerably with the adoption of the recommended alternatives and mitigation measures, as described below.

OPERATIONAL PHASE						
Socio-economic impacts			**No mitigation**		**Mitigation**	
	Sustainability of Arandis		High (-)		Med (+)	
	Permanent employment creation		Med (+)		High (+)	
	Public health & safety		Med (-)		N/A	-----
	Housing & accommodation					
		Arandis	Med (-)		N/A	-----
		Swakop/Walvis	Low (-)		N/A	-----
	Local economies		Med (+)		N/A	-----
	Inward migration		High (-)		N/A	-----
	Schooling		Med (-)		Low (-)	
	Infrastructure					
		Electricity supply	Low (-)		Low (-)	
		Transportation	Med (-)		Med (-)	
Impacts of acid plant & associated storage & transport						
	Air quality		Low (-)		V low (-)	
	Human health					
		Risk assessment	Low (-)		N/A	-----
		Bacteria in cooling water	Med (-)		V low (-)	
		Long term occupational health	Low (-)		N/A	-----
	Visual impact		Low (-)		N/A	-----
	Water resorces		Low (-)		N/A	-----
	Noise & vibration		Med (-)		Low (-)	
	Energy use		Low (+)		N/A	-----
Impacts of ore sorter plant & associated rock disposal						
	Air quality		Med (-)		Low (-)	
	Human health		Low (-)		N/A	-----
	Visual impact		Low (-)		N/A	-----
	Water resources		Low (-)		V low (-)	
	Noise & vibration		High (-)		Low (-)	
	Reject rock disposal					
		Grit blasting yard valley	Med (-)		N/A	-----
		Existing waste dumps	Low (-)		N/A	-----
	Energy use		Med (-)		N/A	-----
Impacts of mining SK4 ore body						
	Air quality		Med (-)		Low (-)	
	Human health		Low (-)		N/A	-----
	Visual impact		Low (-)		N/A	-----
	Water resources		Med (-)		Low (-)	
	Noise & vibration		Med (-)		Low (-)	
	Waste rock disposal		Low (-)		N/A	-----
	Energy use		Med (-)		N/A	-----
	Biodiversity & archaeology of SK4					
		Impact on endemic animal species	High (-)		Med (-)	
		Impact on vegetation	High (-)		Med (-)	
		Impact on archaeology	Low (-)		V low (-)	
		Impact of dust accumulation	Med (-)		Low (-)	
CONSTRUCTION PHASE						
	Generic impacts		V low (-)		N/A	-----
	Employment creation		Med (+)		Med (+)	
	Construction camps					
		Arandis	Med (-)		V low (-)	
		Private/state farms	V low (-)		V low (-)	
		Swakopmund	Low (-)		V low (-)	

High (-)		High (+)	
Med (-)		Med (+)	
Low (-)		Low (+)	
V low (-)			

KEY

Summary table of impact significance

The following have emerged from the SEIA process as the **recommended alternatives**:

- **Reject rock disposal:**
  The most suitable means of dealing with reject rock from the ore sorter plant is believed to be to use existing waste disposal sites in the short to medium term. A long term solution should be sought when the spatial requirements for tailings, waste rock and heap leaching are investigated in Phase 2 of the SEIA.
- **Housing additional RU employees:**
  The preferred alternative recommended for housing for additional RU employees is that it should occur in Swakopmund and/or Walvis Bay.
- **Housing construction workers:**
  Negotiating the housing of construction workers at the construction camp at a mine in the near vicinity of RU is recommended as the preferable alternative.
- **Schooling for RU employees:**
  Collaborating with the government to build new schools is believed to be the preferred option since it is the most sustainable and responsibilities can be clearly defined.

The following have emerged from the SEIA process as the **recommended mitigation measures for those impacts which were shown to be significant** :

Socio-economic

- Impact on the sustainability of Arandis~
  RU should pursue means of economic diversification, to contribute to sustainability.
- Impact of inward migration~
  No substantial mitigation of this impact is foreseen, although RU would strive for their workforce to live in socially stable conditions.
- Impact on schooling for RU employees~
  RU should pursue purposeful and collaborative action to get schools built, in conjunction with government.

Acid plant

- Impact of bacteria in cooling water~
  Water stagnation and process leaks should be minimised and system cleanliness maintained by disinfection, scale and corrosion inhibitors, and efficient mist eliminators on cooling towers.
- Impact of noise and vibration~
  Strictly apply adopted standards and equipment maintenance.

Ore sorter

- Impact of air quality~
  Paving road surfaces, restricting traffic volumes and speed, and better binding of road surfaces should be undertaken.
- Impact of noise and vibration~
  RU should design acoustic damping and acoustic enclosures into the plant, and apply adopted standards and procedures.

Mining SK4

- Impact on air quality~
  Paving road surfaces, restricting traffic volumes and speed, and better binding of road surfaces should be undertaken.
- Impact on water resources~
  Note that these are measures that would be applied elsewhere on the mine, to the benefit of SK4's water requirements. RU should reduce the rate of evaporation from the tailings dam, install more efficient seals on the slurry pumps and use recycled water for dust control at the fine crushers and leach tanks.
- Impact of noise and vibration~
  Adopted standards and procedures should be strictly applied, as well as ensuring careful blast charge calculation, monitoring, early notification, correct stemming of blastholes and equipment maintenance.
- Impact on endemic animal species~
  Improving the level of understanding of the life histories of the species concerned, i.e. continued research.
- Impact on vegetation~
  Reducing the footprint of mining activities as far as possible, rescue and replant the large *Adenia pechuelii* plants, test the viability of rehabilitation and replanting, and improve the level of understanding of the plantlife in the area by continued collection.
- Impact of dust accumulation~
  Improving the level of understanding of the impact of dust on biological soil crust ecosystems, i.e. continued research.

Construction phase impacts

- Impact of a construction camp on Arandis~
  This impact would be avoided by the adoption of the preferred alternative, i.e. for RU to negotiate the use of the construction camp at a mine in the vicinity of RU.

THE WAY FORWARD

A draft version of this SEIA Report was released for review and comment by I&APs, stakeholders, review consultants and authorities. With all the comments and concerns raised having been incorporated in this final SEIA Report, it will now be submitted to MET:DEA for their consideration.

As the environmental practitioners responsible for leading this SEIA process, Ninham Shand are of the opinion that the project components assessed and being applied for, namely the acid plant, ore sorter and mining of SK4, should be positively received by MET:DEA and that an environmental clearance should be issued. This opinion is based on our comprehensive understanding of the environmental impacts likely to result from the acid plant, ore sorter and mining of SK4, as detailed in this and preceding documentation, and that the alternatives and mitigation measures as described and recommended will reduce the identified environmental impacts to an acceptable level.

29 February 2008

1 INTRODUCTION AND BACKGROUND

The purpose of this chapter is to provide the context for the proposed expansion project and to introduce the Social and Environmental Impact Assessment Report. After providing the background, it describes the policy and legal framework within which the assessment has been undertaken. Thereafter, the chapter outlines the assessment process to date, its assumptions and limitations, and the approach to the present stage in the assessment process. This chapter ends with a brief section on the context and structure of the remaining chapters of the report.

1.1 INTRODUCTION

Rössing Uranium (RU) has operated an open pit uranium mine in the Erongo Region of Namibia since 1976. Figure 1 overleaf provides a locality map for the mine. Although of considerable extent, the Rössing ore body is of a low grade and consequently large volumes of rock have to be mined and processed to extract the powdered uranium concentrate that is the final product.

As a result of an increase in uranium prices on the international market in recent years, RU is able to consider the possible financial benefit from an expansion of its operations. The previous mine plan predicted an operational period ending in the year 2016. According to this plan, a sustainability assessment was undertaken and approved in 2005. RU is now looking at a mine plan beyond 2016 and consequently, the associated social and environmental issues are being reviewed.

In terms of the Namibian Constitution (Government of Namibia 1990) and related environmental legislation, in particular the Environmental Assessment Policy (MET 1995) and the Minerals Act (No. 33 of 1992), the proposed expansion activity would require authorisation from the responsible authorities before it can be undertaken. Insofar as the environmental acceptability of RU's proposed expansion project is concerned, the Ministry of Environment and Tourism's Directorate of Environmental Affairs (MET:DEA) would need to issue a clearance for such expansion.

A Social and Environmental Impact Assessment (SEIA)[1] has thus been commissioned by RU for their proposed expansion project, as required by the Environmental Assessment Policy (MET 1995) but also informed by the principles of Namibia's Environmental Assessment and Management Act[2], as well as the internal standards and guidelines prescribed by Rio Tinto, RU's parent company. MET:DEA's clearance would be based on the outcomes of the present study and this Social and Environmental Impact Assessment Report (SEIA Report) serves to

[1] It is recognised that the term "environment" when applied in the context of an environmental impact assessment refers to the total environment, i.e. encompassing both the socio-economic and biophysical environments. Notwithstanding this recognition, however, RU prefers to retain the term "social" in the title of the present environmental impact assessment, as a clear indication of their commitment to the human element in the affected environment and in keeping with their Sustainable Development Frameworks.
[2] Approved by the Namibian Parliament during October 2007 and gazetted on 27 December 2007 as the Environmental Management Act (No. 7 of 2007).

document the assessment stage of the process. RU presently has a mining licence issued by the responsible sector ministry, i.e. the Ministry of Mines and Energy (MME), that is valid until 2019 and that covers the areas affected by their currently proposed developments.

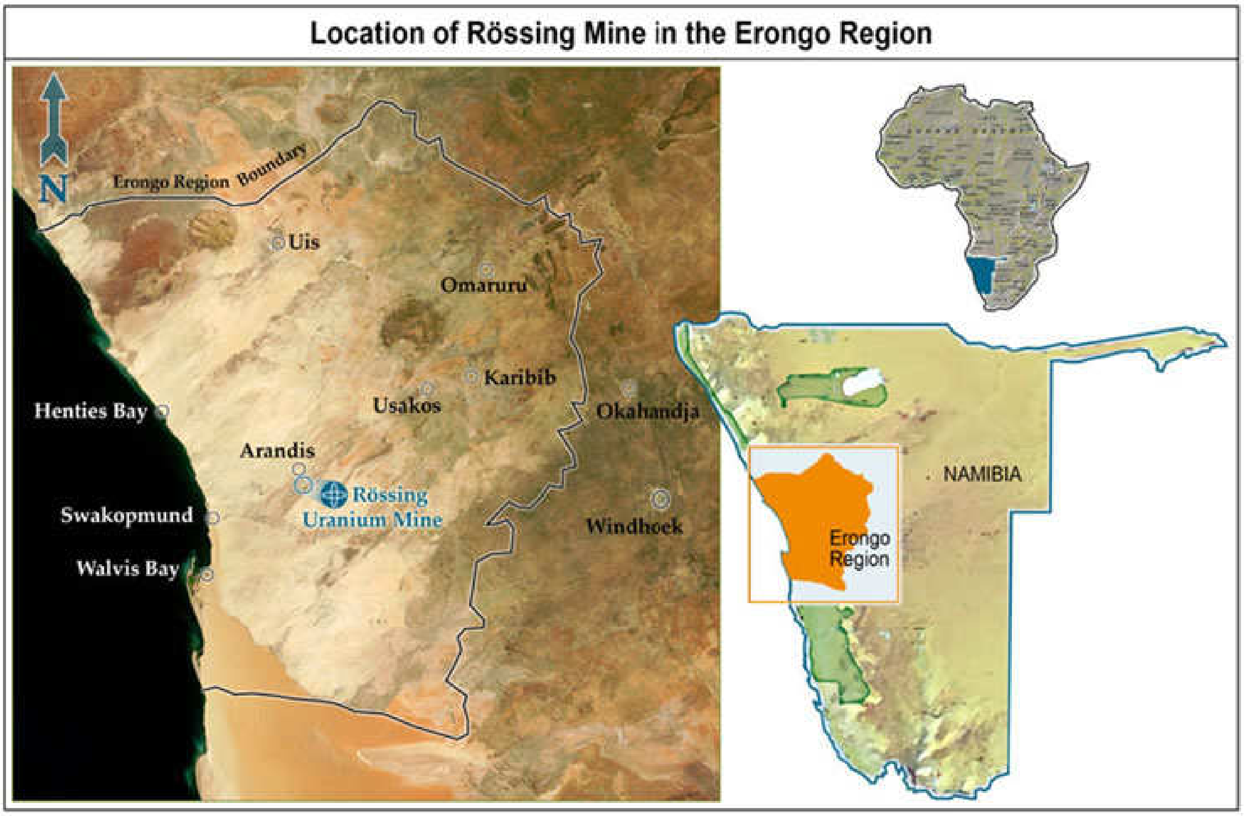


Figure 1: Locality map (source: RU)

The entire extent of the envisaged expansion of the Rössing mine would comprise, in summary, nine individual components. These are being dealt with in two phases of the SEIA process, as follows:

- A sulphuric acid manufacturing plant with associated sulphur storage on the mine, and the transport of sulphur from the Port of Walvis Bay;
- A radiometric ore sorter plant;
- Mining of an ore body known as SK4;

Phase 1

- Extension of the current mining activities in the existing SJ pit;
- New mining activity in the larger SK area;
- Increased tailings disposal capacity;
- Increased waste rock disposal capacity;
- Establishing an acid heap leaching facility; and
- Sulphur handling in the Port of Walvis Bay.

Phase 2

The reason for separating these components into the two phases is that the engineering design and detailed feasibility studies for each of the nine components are not occurring simultaneously. This is due to the complex and highly technical nature of the various expansion project components necessitating a sequential approach to the execution of the proposed developments. It is understandable that economic and engineering criteria may influence the feasibility of RU's entire expansion project during the formulation and approval stages of the project cycle.

> It is therefore important to note that only three specific components of RU's expansion project are the subject of this SEIA Report, *viz*. a **sulphuric acid plant** and associated sulphur storage and transport, a radiometric **ore sorter plant** and the mining of an ore body known as **SK4**. As indicated above, these components are referred to as Phase 1 of RU's expansion project. The remaining expansion project components, referred to as Phase 2, will be dealt with in another assessment process during 2008. Interested and affected parties (I&APs) and stakeholders registered for the present Phase 1 of the SEIA will be kept informed once the Phase 2 process is launched.

A graphic representation of the timing of the assessment and implementation phases for the SEIA process of RU's expansion project is provided in Figure 2.

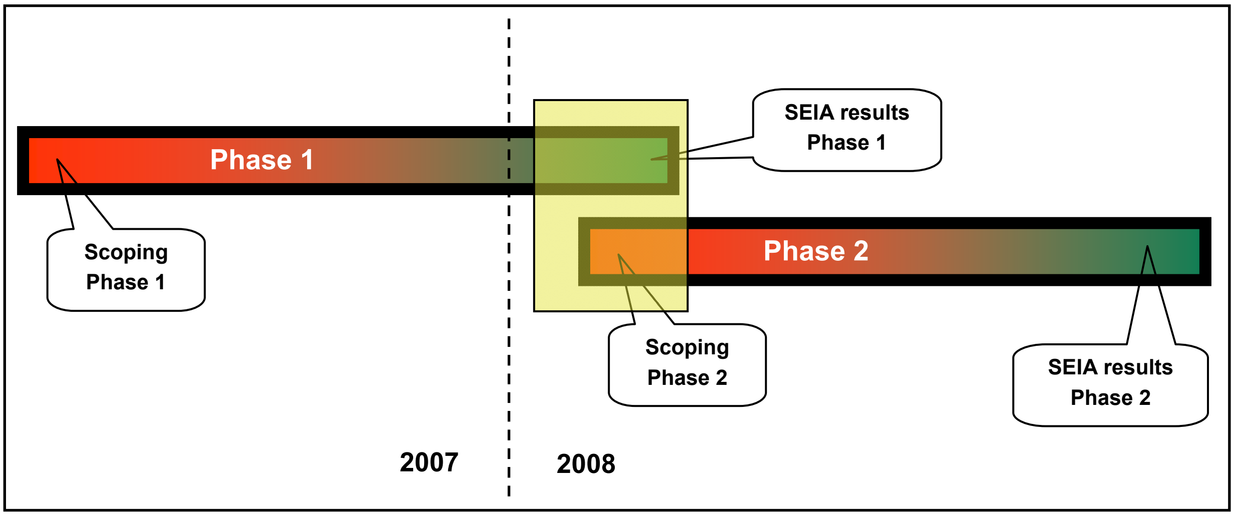


Figure 2: SEIA assessment and implementation phases (source: RU public participation information)

The SEIA process for Phase 1 and its sequence of supportive documentation, as envisaged for the specified components of RU's expansion project, are illustrated in Figure 3. It should be noted that the Scoping stage of the process that precedes this assessment stage has been completed and that the Scoping Report for Phase 1 was released during November 2007.

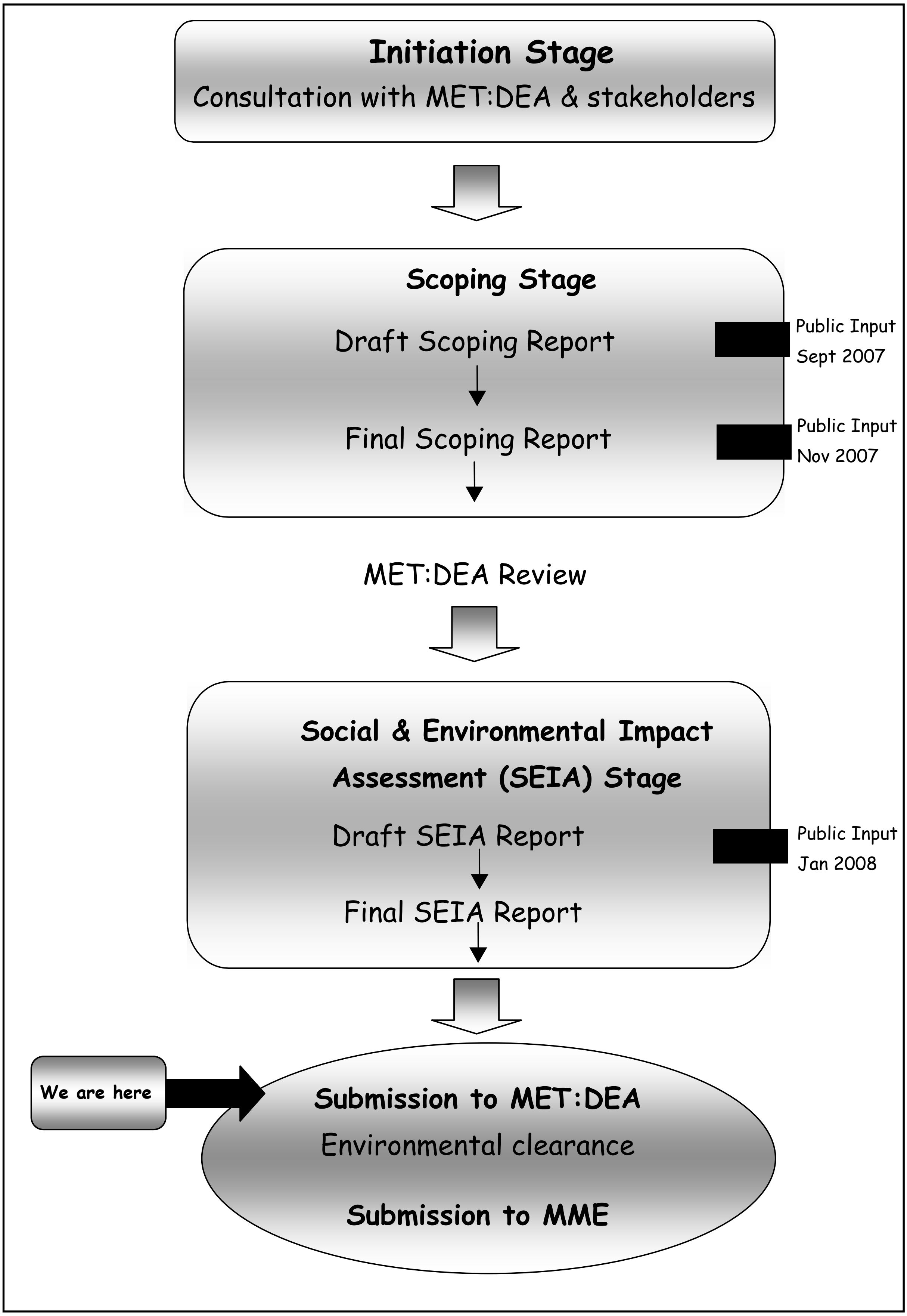


Figure 3: The SEIA process

The series of documents that support the present Phase 1 SEIA process, and that culminate in this finalised SEIA Report, comprise the following:

- A *Public Information Document* released in August 2007 to initiate the SEIA process;
- A *Scoping Report* released in November 2007;
- A *Draft SEIA Report* released in January 2008, comprising two volumes:
  - *Volume 1 – Main Report*
  - *Volume 2 – Annexures*, comprising Draft Social and Environmental Management Plan, minutes of public participation meetings and specialist reports; and
- This *Final SEIA Report* of February 2008, comprising the same two volumes in amended form.

A bibliography is included in Section 7 of this report, that provides reference to other studies and reports that are of relevance to this SEIA process.

The purpose of this final SEIA Report is to document the assessment stage of the process and it briefly comprises the following:

- An outline of the legal and policy framework regarding the environment, within which RU operates and this assessment is undertaken;
- A description of the proposed Phase 1 components, their alternatives and potential impacts;
- A description of the public participation process undertaken to date, and the way forward with this process;
- A description of the assessment methodology applied; and
- Most importantly, an assessment of the significance and possible mitigation of the potential impacts that were identified during the Scoping stage of the SEIA process.

A description of the socio-economic and biophysical context of the proposed developments was provided in the Scoping Report for the SEIA process (Ninham Shand, 2007) and should be referred to in conjunction with this final SEIA Report.

A number of specialist studies have been undertaken to properly understand the most significant potential impacts of the proposed developments and to ensure an acceptable level of confidence in the assessment of such impacts. The outcomes of the SEIA stage of the process include:

- Confirmation of the environmental acceptability of the preferred or indicated sites for the proposed acid plant and associated sulphur handling and storage facilities, the radiometric ore sorter plant and the new SK4 pit;
- Identification or confirmation of the environmentally preferred process and technology alternatives;
- Identification of possible mitigation measures to reduce the significance of potential impacts; and

- Documentation of the identified mitigation measures in a Social and Environmental Management Plan.

As indicated in Figure 3, the SEIA stage is the last stage in the SEIA process. Accordingly, an SEIA Report aims to collate, interrogate, analyse and synthesize information from a range of sources, to provide sufficient and reliable information for MET:DEA to make an informed decision on whether or not the proposed Phase 1 components of RU's expansion project are acceptable from a social and environmental perspective.

1.2 POLICY FRAMEWORK

As a significant contributor to the Namibian economy[3], RU's role in local and regional economic development requires that they demonstrate adherence to sound environmental practices. The decision to pursue possible expansion of their operations thus needed to be underpinned by informed strategic planning. To this end, the following hierarchy of policy, planning and procedural documentation (Figure 4) reflects the point of departure for the proposed expansion project:

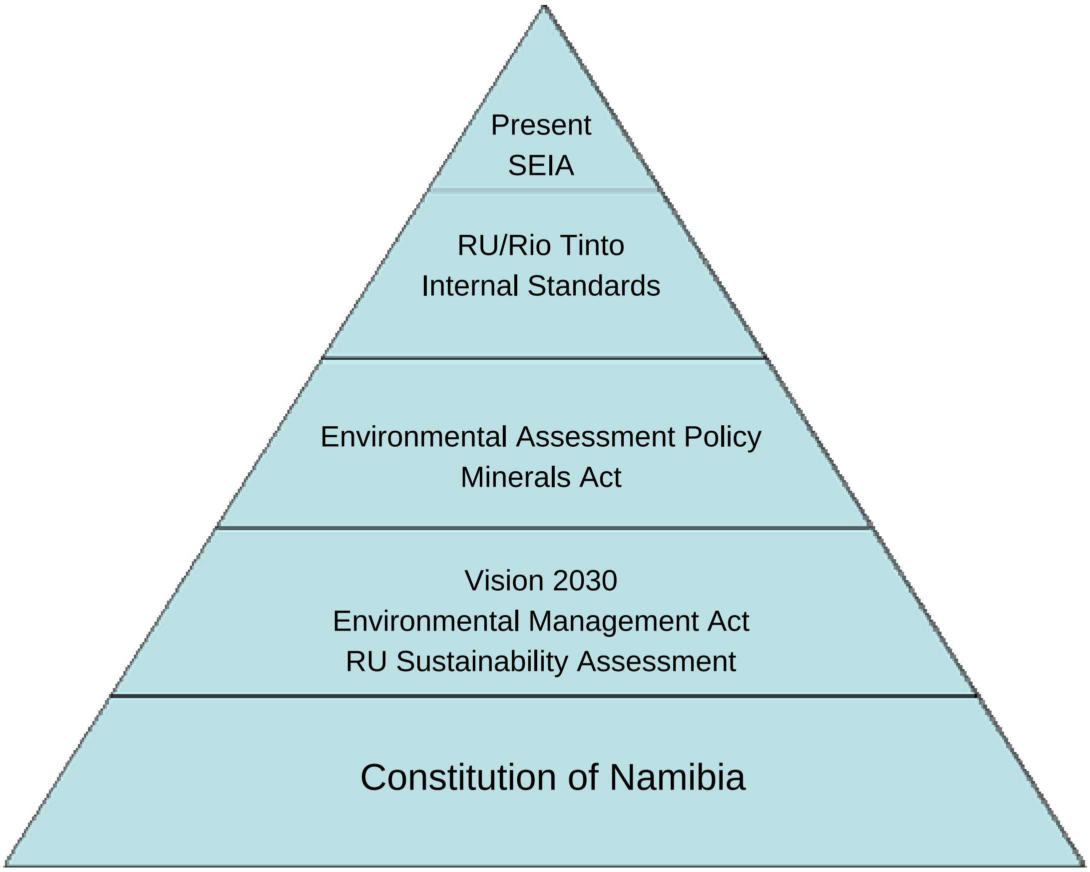


Figure 4: Hierarchy of policy and planning documents

[3] In 2001 RU contributed 2.5% of Namibia's Gross Domestic Product (GDP) and 10% of the country's export earnings (Sustainability Assessment 2004).

The strategic policy and planning documents reflected in Figure 4 above are now briefly described. Regulated procedural requirements are dealt with in more detail in Section 1.3 below, together with other standards, conventions and relevant pending legislation.

1.2.1 The Constitution of the Republic of Namibia

There are two clauses contained in the Namibian Constitution that are of particular relevance to sound environmental management practice, *viz*. articles 91(c) and 95(l). In summary, these refer to:

- guarding against over-utilisation of biological natural resources;
- limiting over-exploitation of non-renewable resources;
- ensuring ecosystem functionality;
- protecting Namibia's sense of place and character;
- maintaining biological diversity; and
- pursuing sustainable natural resource use.

The State is thus committed to actively promoting and maintaining the environmental welfare of Namibians by formulating and institutionalising policies that can realise the above-mentioned sustainable development objectives. As an important role-player in the beneficiation of Namibia's non-renewable mineral resources, RU has demonstrated its alignment with these constitutional principles.

1.2.2 Vision 2030

The principles that underpin Vision 2030[4], a policy framework for Namibia's long-term national development, comprise the following:

- good governance;
- partnership;
- capacity enhancement;
- comparative advantage;
- sustainable development;
- economic growth;
- national sovereignty and human integrity;
- environment; and
- peace and security.

In pursuing the further development of the uranium resources available to it, RU is in a position to contribute significantly to the realisation of the Vision 2030 principles.

[4] Derived from Namibia's Green Plan drafted by MET in 1992 and followed by the sequence of National Development Plans.

Other forward-planning initiatives related to the Vision 2030 policy towards Namibia's national development, the tourism sector and to natural resource management are the Erongo Region Development Plan (2000), MET's North West Tourism Master Plan and the Namib Coast Conservation and Management project respectively.

1.2.3 Environmental Management Act

In giving effect to articles 91(c) and 95(l) of the Constitution of Namibia, general principles for sound management of the environment and natural resources in an integrated manner have been formulated. This has resulted in an Environmental Assessment and Management Act being approved by the Namibian Parliament in October 2007. It was gazetted on 27 December 2007 as the Environmental Management Act (No. 7 of 2007), Government Gazette No. 3966. Part 1 of the Environmental Management Act describes the various rights and obligations that pertain to citizens and the Government alike, including an environment that does not pose threats to human health, proper protection of the environment, broadened *locus standi* on the part of individuals and communities, and reasonable access to information regarding the state of the environment.

Part 2 of the Act sets out 13 principles of environmental management, as follows:

- Renewable resources shall be utilised on a sustainable basis for the benefit of current and future generations of Namibians.
- Community involvement in natural resource management and sharing in the benefits arising therefrom shall be promoted and facilitated.
- Public participation in decision-making affecting the environment shall be promoted.
- Fair and equitable access to natural resources shall be promoted.
- Equitable access to sufficient water of acceptable quality and adequate sanitation shall be promoted and the water needs of ecological systems shall be fulfilled to ensure the sustainability of such systems.
- The precautionary principle and the principle of preventative action shall be applied.
- There shall be prior environmental assessment of projects and proposals which may significantly affect the environment or use of natural resources.
- Sustainable development shall be promoted in land-use planning.
- Namibia's movable and immovable cultural and natural heritage, including its biodiversity, shall be protected and respected for the benefit of current and future generations.
- Generators of waste and polluting substances shall adopt the best practicable environmental option to reduce such generation at source.
- The polluter pays principle shall be applied.
- Reduction, reuse and recycling of waste shall be promoted.
- There shall be no importation of waste into Namibia.

As reflected in the policy statement described in Section 1.3.3, there is a clear commitment to pursuing these principles of environmental management on the part of RU as the proponent of the expansion project.

1.2.4 RU Sustainability Assessment

In determining the viability of extending the life of the Rössing uranium mine, RU has undertaken a detailed sustainability assessment (RU, 2004). This sustainability assessment is in support of the engineering and financial feasibility studies that were the primary informants in considering such an extension of the life of the mine.

It is important to note that a sustainability assessment considers impacts that may result from a proposed development at a broader level than the site-specific impacts. The aims of the 2004 sustainability assessment were thus to:

- Identify any aspects of the proposed expansion project that could present fatal flaws that could be contrary to any development at all;
- Identify the opinions of all stakeholders and interested and affected parties, insofar as any real concerns that emerged could influence the future of the mine;
- Evaluate the risks and benefits of extending the life of the mine to either 2016 or 2026, compared to early closure in 2007; and
- Suggest possible mitigatory measures to minimise potentially negative impacts, as well as means of enhancing the positive impacts that may result from extending the life of the mine.

Developing a measure of sustainability, in terms of quantifying the net social and environmental[5] advantages or disadvantages of the proposed expansion project, thus allowed RU to consider the next step in the development process, *viz*. whether the project could be implemented within acceptable environmental parameters. The sustainability assessment is consequently a vital strategic informant in undertaking the present SEIA.

1.3 LEGAL REQUIREMENTS, STANDARDS AND CONVENTIONS

In order to protect the environment and ensure that RU's proposed expansion project is undertaken in an environmentally responsible manner, there are two significant pieces of environmental legislation that focus this assessment, *viz*. Namibia's Environmental Assessment Policy and the Minerals Act. These are reflected below, followed by reference to other legislation, standards and conventions.

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[5] Note that the term "environment" in this sense is understood to refer to the total environment, i.e. to encompass both biophysical as well as socio-economic aspects.

1.3.1 Namibia's Environmental Assessment Policy of 1994

Appendix B of Namibia's Environmental Assessment Policy contains a schedule of activities that will have significant detrimental effects on the environment and which require authorisation from MET:DEA. The nature of RU's proposed expansion project includes activities listed in this schedule. The primary triggers[6] are, *inter alia*:

> *"10~ Transportation of hazardous substances and radioactive waste*
> *11~ Mining, mineral extraction and mineral beneficiation*
> *12~ Power generation facilities with an output of 1MW or more*
> *14~ Storage facilities for chemical products*
> *15~ Industrial installation for bulk storage of fuels*
> *36~ Water intensive industries*
> *39~ Effluent plants*
> *46~ Chemical production industries*
> *50~ Waste disposal sites"*

Accordingly, the proposed expansion project requires authorisation from MET:DEA, and their decision will be based on the findings of the present SEIA process. It is believed that the SEIA process that has been undertaken has met the requirements of such processes, as described in Appendix A of the Environmental Assessment Policy.

1.3.2 Namibia's Minerals Act of 1992

A provision of the Minerals Act, specifically Section 48 (2) (b) (i) of the Act, is that *"environmental impact studies"* may be called for by the Minister of Mines and Energy when mineral licences - or their renewal or transfer - are applied for.

RU is presently operating under a mining licence valid until 2019 issued by MME and this will cover the proposed Phase 1 developments. However, copies of the earlier Draft SEIA Report, as well as this finalised SEIA Report, is being submitted to the Ministry for their information.

1.3.3 RU/Rio Tinto's Internal Standards

Rio Tinto, RU's parent company, operates a comprehensive Environmental Management System (EMS) that accords with international standards of best practice. An array of environmental standards are thus in place and all Rio Tinto businesses, such as RU, are committed to maintaining such international standards. Rio Tinto's policy statement titled *The Way We Work* provides the overarching environmental touchstone, while matters of planning, implementation and operation, checking and corrective action, and management review, are embodied in the Rio Tinto Health, Safety, Environmental and Quality Management System

[6] Given the complex nature of the proposed expansion project, other activities may also serve as triggers. However, the comprehensive SEIA being undertaken will address all of the impacts identified during the process.

(HSEQ MS), that each business unit, like Rössing mine, is obliged to maintain. The system is implemented at different times throughout Rio Tinto and Rössing has to be fully compliant by the end of 2008. The HSEQ MS is based on the principles of internationally applied management systems for health, safety, environment and quality including the relevant ISO standards. RU was already certified compliant with the ISO 14001, Environmental Management Systems in February 2001 and recertified in 2004 and 2007. Certification services and independent third party auditing will continue through a Rio Tinto nominated international auditing organisation to ensure continued compliance to the standard throughout the group.

Specifically as it relates to the proposed expansion project, the planning component of RU's EMS requires that the project is treated as a new activity and is thus subjected to "…*previous identification of (its) environmental aspects and impact assessment*…" and that the assessment of the project is measured against related environmental performance indicators. This may be interpreted as an explicit intention to undertake the present SEIA in accordance with local statutory requirements and international best practice.

1.3.4 Other legislation and conventions

In addition to the Environmental Assessment Policy, the Minerals Act and RU's internal standards described above, the following additional pieces of existing or pending legislation and conventions may have some bearing on the proposed expansion project:

The socio-economic environment~

- National Heritage Act (2004)
- Labour Act (1992), in particular the Regulations Relating to Health and Safety of Employees at Work
- Primary Health Care Policy (1990)
- National Code on HIV/AIDS and Employment (1996)
- Marriage Equality Act (2002)
- Combating of Rape Act (2002)
- National Employment Policy (1997)
- Decentralisation Policy (1998)
- Pending Minerals Safety Bill
- Pending Atomic Energy Board and Radiation Protection Authority Bill
- International Atomic Energy Agency Non-proliferation Treaty (1970)
- National Environmental Health Policy (2002)

The biophysical environment~

- Water Act (1956) and pending Water Bill
- Water Resources Management Act (2004)
- Atmospheric Pollution Prevention Ordinance (1976) and pending Pollution Control and Waste Management Bill
- Draft Minerals Policy (2002)
- Ramsar Convention (1975)

- Convention on Biological Diversity (2000)
- Convention to Combat Desertification (1997)
- United Nations Framework Convention on Climate Change (1992)
- Environmental Management Act (2007)

The extent to which these pieces of legislation and conventions may be relevant to the undertaking of the expansion project SEIA are being evaluated as the process continues. To date, no specific concerns have been raised regarding other legislation or conventions. Other government departments and statutory institutions that may have an interest in or responsibility for the SEIA process, such as the Ministry of Agriculture, Water and Forestry, the Department of Mines and Energy, NamPower, NamPort and TransNamib have been provided with copies of the Scoping Report as well as the Draft SEIA Report, for their comment. This finalised SEIA Report is also being made available to them.

1.4 THE SEIA PROCESS TO DATE

The SEIA process being undertaken is illustrated in Figure 3 in Section 1.1 above. As can be seen, the Initiation Stage and Scoping Report Stage have been completed and the SEIA Report Stage is nearing completion. To date, the SEIA process has comprised the following tasks:

- Consultation with the Head of the Environmental Impact Assessment Unit at MET:DEA during August 2007, which resulted in a letter confirming their acceptance of the registration and screening of the SEIA process. A copy of this letter was provided in the Scoping Report. This represents the formal initiation of the SEIA process;
- Undertaking a comprehensive public participation process. This vital component of the SEIA process is the responsibility of Marie Hoadley, an independent public facilitation and social assessment practitioner. The public participation tasks completed to date are reported in detail in Section 3 and the process is on-going;
- Consultation with key stakeholders (national, regional and local government authorities, and other statutory institutions);
- Compilation, review, finalisation and subsequent release during November 2007 of the Scoping Report to MET:DEA and key stakeholders[7];
- Commissioning of specialist studies, after a scoping site visit and workshop, and finalisation of the scope of the specialists' studies. The Scoping Report provides details of the specialists in question and the scope of their work;
- Compilation of the earlier Draft SEIA Report, after receiving the various specialist reports and further consultation with key stakeholders and project team members;
- Submission of the Draft SEIA Report to MET:DEA as the primary environmental authority, as well as its release to I&APs and other key stakeholders; and
- Revision of the Draft SEIA Report, in response to inputs from authorities, I&APs, stakeholders, independent review consultants and the project team, to this finalised version of the SEIA Report.

[7] MET:DEA receipt of the Scoping Report was confirmed telephonically by Dr F Sikabongo.

The SEIA Scoping Report of November 2007 for Phase 1 of RU's expansion project outlined the full range of potential environmental impacts and feasible project alternatives and how these were derived. It also described the proposed approach to the assessment and the methodology to be applied. It is thus important that this SEIA Report is read in conjunction with the Scoping Report of November 2007.

The SEIA Report has collated, interrogated, analysed and synthesized information from a range of sources and it is believed that it provides sufficient and reliable information for informed decision-making regarding the proposed Phase 1 components of RU's expansion project.

1.5 ASSUMPTIONS AND LIMITATIONS

The process that this SEIA Report is part of is limited to the specific components of the Phase 1 expansion project detailed in Section 2 and is being undertaken in terms of Namibia's Environmental Assessment Policy and internationally recognised best practice in environmental assessment. In developing the approach to this project, Ninham Shand took cognisance of RU's deliberations regarding their sustainability assessment (Golder, 2004).

Specific assumptions that have been made are:

- Regarding the assessment of relevant project-level alternatives, it emerged from the Scoping stage of the assessment that the number of such alternatives is limited. This is not a shortcoming in the process, however, since the principle of applying best practice and the adoption of the most environmentally appropriate technology has informed the engineering design of the expansion project components. The SEIA nevertheless determines the acceptability of such best practice and appropriate technology.

- Due to the complexity of the present SEIA, in terms of the variety of different components being addressed and the sequencing of related engineering design, there are cases where the available information is incomplete or not available timeously. As indicated in the Scoping Report, where such information gaps are a shortcoming in the assessment, these would be clearly identified. However, where the subject matter is well understood and not critical to the assessment, provision has been made for their inclusion in the decision-making process in the Social and Environmental Management Plan (SEMP) that accompanies the SEIA Report. Note that a life cycle analysis is not included in the brief for this SEIA.

- A case in point regarding the availability of information and design finalisation is the situation relating to sulphur handling and storage in the Walvis Bay harbour. This element of the SEIA has had to be excluded from the present assessment process, due to RU identifying alternative sites which may be more beneficial than the area originally being discussed with Grindrod, the operators of the bulk handling terminal. Section 2.2.2 a) provides the context for this situation. If a different location is selected, RU will initiate a separate assessment process for their own sulphur handling and storage facility in the harbour. I&APs and stakeholders registered for the present Phase 1 of the SEIA will be kept informed of progress regarding this separate assessment once it is launched.

- While external review will be carried out by the Southern African Institute for Environmental Assessment, Ninham Shand is also undertaking internal review throughout the process. The latter will be carried out by a recognised expert with particular knowledge of the Rössing site and operations, as described in the Scoping Report. In this way, assurance of a world-quality product can be given.

1.6 APPROACH TO THE SEIA STAGE

1.6.1 The SEIA Report Stage

As outlined in the Scoping Report, there are three distinct phases in the SEIA process, as described generically in Appendix A of Namibia's Environmental Assessment Policy, namely the Initiation Stage, the Scoping Report Stage and the SEIA Report Stage. Figure 3 in Section 1.1 summarises the process followed. This document addresses the final phase, namely the SEIA Report Stage.

The purpose of the SEIA Report is to describe and assess the range of project actions and, where possible, the feasible alternatives formulated during the Scoping Stage, in terms of the potential environmental impacts identified. The ultimate purpose of the SEIA Report is to provide a basis for informed decision, firstly by RU as the proponent, with respect to the development options they wish to pursue, and secondly by the authorities regarding the acceptability of the proponent's preferred development options.

The approach to the SEIA Report Stage has entailed the following:

- Undertaking further review of relevant information.

- Appointing various specialists to undertake the specialist studies identified during the Scoping Report Stage, namely:

  - Air quality study, undertaken by Airshed Planning Professionals;
  - Quantitative risk assessment, undertaken by Riscom;
  - Visual impact assessment, undertaken by Visual Resource Management Africa;
  - Social impact assessment, undertaken by Marie Hoadley Independent Consultant;
  - Biodiversity, undertaken by Environmental Evaluation Associates of Namibia;
  - Water resource management, undertaken by Sandra Müller of RU[8];

[8] Engaging RU and Rio Tinto staff members to undertake these specialist studies is considered acceptable in this case, given their recognised expertise in these fields. The internal and external independent reviews that the Scoping Report and SEIA Report have been subjected to provide reassurance of independence.

- Noise and vibration study, undertaken by Namibian Vibration Consultants; and
- Energy use assessment, undertaken by Svenja Garrard of Rio Tinto Technology & Innovation (Rio Tinto T&I)[8].

Note that the specialised areas of radioactivity and public dose assessment, archaeology and mineral waste and tailings management have not been subjected to specific studies in the Phase 1 SEIA. This is due to the availability of existing relevant information from already completed studies and reports in these fields, that have provided an adequate level of information for the Phase 1 SEIA assessment. The Scoping Report of November 2007 provides details in Section 1.7 of the organisations and fields of expertise that addressed these specialist areas. Where relevant, additional attention will be paid to these specialist areas in Phase 2 of the SEIA process.

- Compiling this SEIA Report, based on the collation, interrogation, analysis and synthesis of all relevant information. This allows for the description and assessment of the significance of identified potential impacts associated with the proposed Phase 1 development, with the objective of providing a balanced view of the proposed activities and their implications for the environment. The relevant information referred to includes the specialist reports, the comments and concerns from the public and stakeholders, and input from the project team.

1.6.2 Decision-making and authority involvement

As indicated earlier, MET:DEA is the competent environmental authority and will make a decision in light of the information presented in the SEIA Report. If the decision is positive, MET:DEA will issue a clearance for the proposed Phase 1 development.

There are other authorities and institutions that have a commenting role to play in the SEIA process. Their comments on the SEIA Report will help to inform MET:DEA's decision making. These authorities and institutions include *inter alia*:

- Ministry of Agriculture, Water and Forestry;
- NamPower;
- NamPort; and
- TransNamib.

Comments from these authorities on the earlier Draft SEIA Report were sought as far as possible and it should be noted that several other authorities and statutory institutions, in particular the regional and local councils and municipalities, were approached as stakeholders in the public participation process. See Section 3 in this regard.

1.7 CONTEXT AND STRUCTURE OF THIS REPORT

As outlined above, the assessment process undertaken to date included the production of a comprehensive Scoping Report which provided detailed information relevant to the project.

However, for the sake of being succinct, information contained within the Scoping Report is not repeated within this SEIA Report unless it has a direct bearing on the issues under discussion.

Accordingly, to ensure a holistic understanding of the project, the nature of the activities and the substance of the assessment process, it is necessary that this SEIA Report is read in conjunction with the Scoping Report (Ninham Shand, November 2007).

The structure of this SEIA Report has been guided by the Nambian Environmental Assessment Policy. It has also been informed by the South African Department of Environmental Affairs and Tourism's *Environmental Impact Reporting Guideline* (Gov of SA, 2004), as well as by the review approach formulated by the Southern African Institute for Environmental Assessment that appears as Appendix A of the DEAT *Review in EIA Guideline* (Gov of SA, 2004). In this way, informed decision-making by the proponent and the competent environmental authority should be facilitated. The SEIA Report and preceding Scoping Report contain the following information:

- A description of the approach adopted and methodology used in compiling the documentation;
- A description of the proposed project;
- An assessment of the alternatives relevant to the proposed project;
- A description of the affected environment;
- A description of the potential impacts of the proposed project;
- A consideration of measures to mitigate the potential impacts;
- A conclusion and various recommendations with regard to the way forward;
- A series of annexures containing relevant information, including the various specialist studies and details of the public participation process; and
- A non-technical summary.

This Draft SEIA Report is structured as follows:

Chapter One	*Provides the introduction, policy and legislative framework, details of the SEIA process and approach to the assessment*
Chapter Two	*Describes the project proposal, including identification of alternatives and potential impacts*
Chapter Three	*Describes the public participation process*
Chapter Four	*Describes the assessment methodology*
Chapter Five	*Discusses and assesses the identified potential impacts and mitigation measures*
Chapter Six	*Concludes the report, describes the recommendations being made and indicates the way forward*

2 DESCRIPTION OF THE PROJECT AND IDENTIFICATION OF ALTERNATIVES AND POTENTIAL IMPACTS

The purpose of this chapter is to briefly describe the proposed project, namely the sulphuric acid production plant and associated sulphur storage and transport, the radiometric ore sorter plant and associated reject rock disposal, and the development of the SK4 ore body[9]. The chapter then summarises the alternatives identified in the Scoping Report of November 2007 and describes the potential impacts that were proposed for further consideration during the assessment stage of the present SEIA process. Figure 5 provides a graphic overview of the Rössing mine and related infrastructure in the Erongo Region, and Figure 6 shows the components of the proposed project described in this chapter.

2.1 PROJECT DESCRIPTION

2.1.1 Sulphur burning sulphuric acid plant and associated sulphur storage and transport

a) Context

RU's metallurgical process uses sulphuric acid leaching to extract the uranium from the ore. An onsite pyrite burning acid plant was in use until 1997, after which it was converted to burn sulphur imported through Walvis Bay and railed to the mine. It was mothballed in 2000 when prices of imported acid fell below production cost. Public concerns had been raised at the time, when sulphur spillage next to the railway line was found. Concerned members of the public had queried whether the material was the uranium oxide "yellow cake" produced by the mine.

Since 2000, the entire mine's acid requirements have been imported via Walvis Bay harbour. Current economic evaluations show that value may be gained by establishing a new sulphuric acid production plant at the mine, while continuing to import additional acid if required. Figure 7 provides a graphic representation of the acid production history at RU since 1976.

The following items comprise this project component:

- A sulphuric acid production plant to be built at the Rössing mine site;
- The existing on-site acid storage facilities to be upgraded and utilised to store imported or produced acid;
- The importation of acid through Walvis Bay harbour to continue but at a reduced rate, and the acid offloading and rail loading facilities as well as the tank farm at the harbour

[9] Note that a more detailed project description of the three components is provided in the Scoping Report of November 2007.

to be maintained. Transport of acid by rail to the Rössing mine site to continue as required;

- Rail transport by TransNamib through Walvis Bay and Swakopmund to continue;
- The waste heat from the acid plant to be converted by means of a turbine generator set to produce electricity for internal consumption. The option of using steam for enhanced uranium recovery is still an option which may be implemented in the future but is not seen as an important factor in the present SEIA process;
- Preliminary site selection exercises have indicated that the new plant should be positioned near the existing offloading and storage facilities (see Figure 6); and
- Elemental sulphur to be imported via ship from Walvis Bay harbour and transported by rail to the Rössing mine site. Bulk sulphur storage and handling facilities will be built at Walvis Bay harbour as well as at Rössing mine. Note, however, that the envisaged storage and handling facility at Walvis Bay will be the subject of a separate environmental assessment process, as described in Section 1.5. The present SEIA addresses sulphur storage and handling only from the point of departure in Walvis Bay harbour via rail transportation to the mine site. Specialised railcars, purpose-designed for the transport of elemental sulphur, are being investigated by RU.

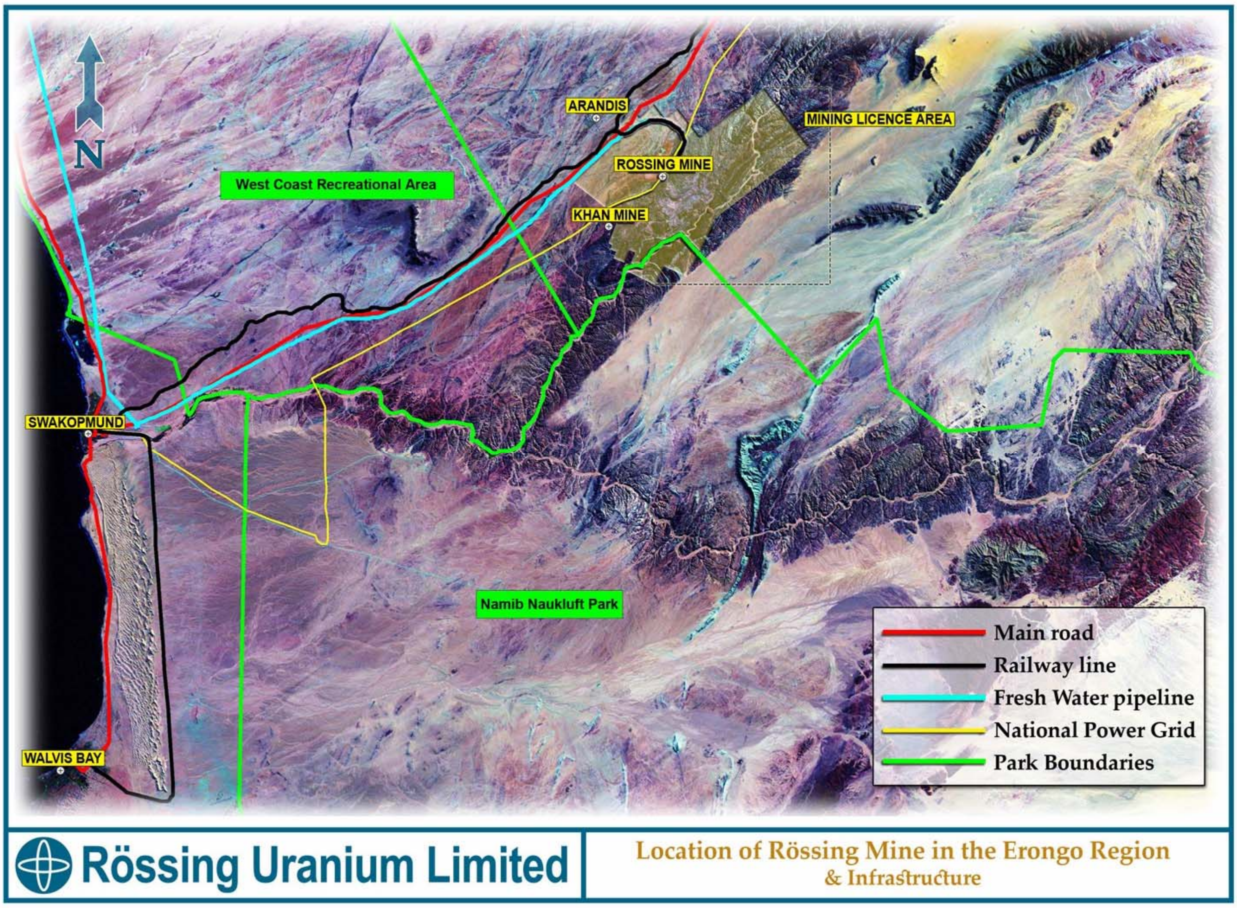

Figure 5: Location of the Rössing mine and related infrastructure in the Erongo Region
(source: RU)

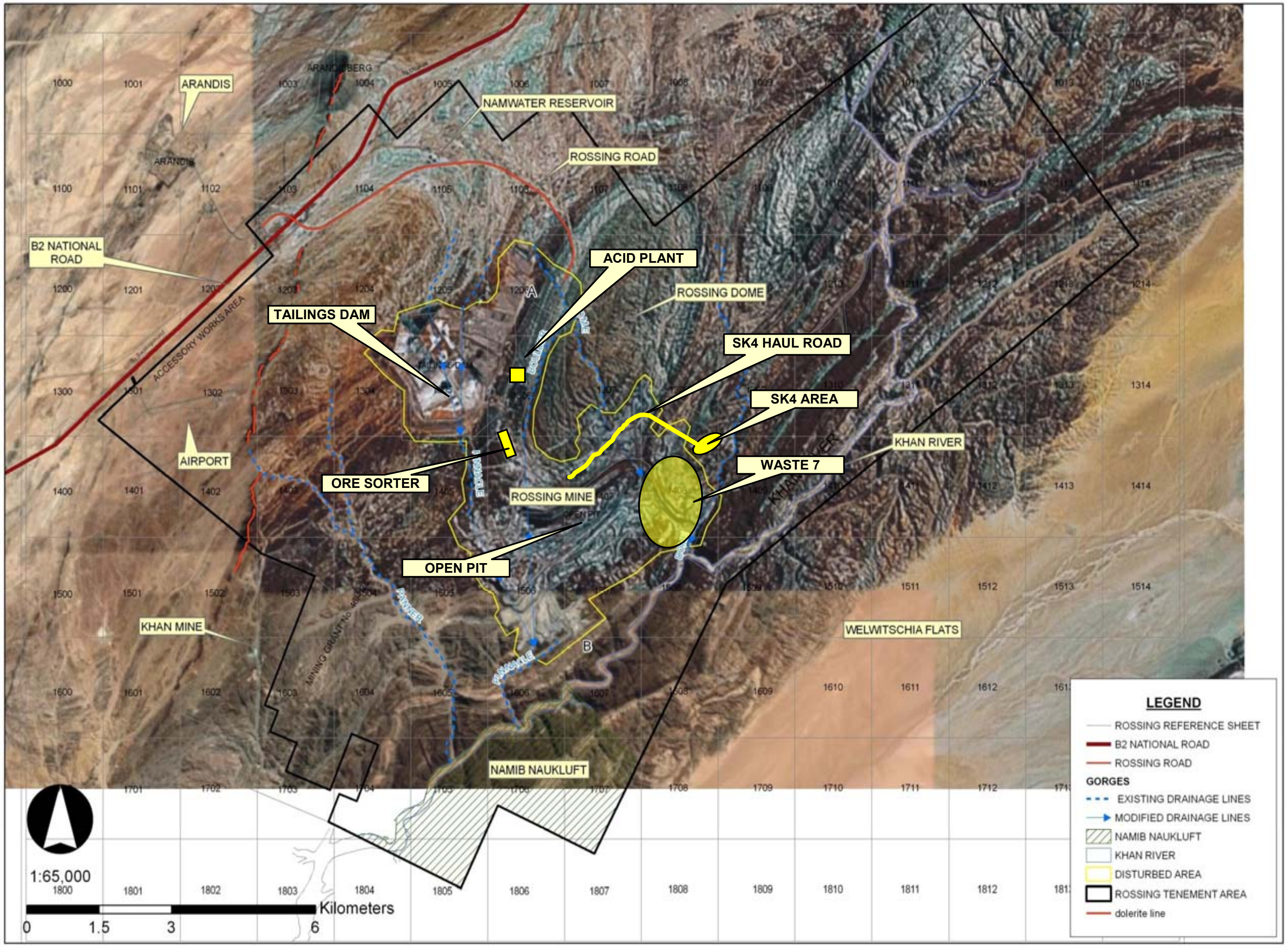

Figure 6: Overview of proposed Phase 1 project components (source: modified from Visual Impact Assessment : VRMA, 2007)

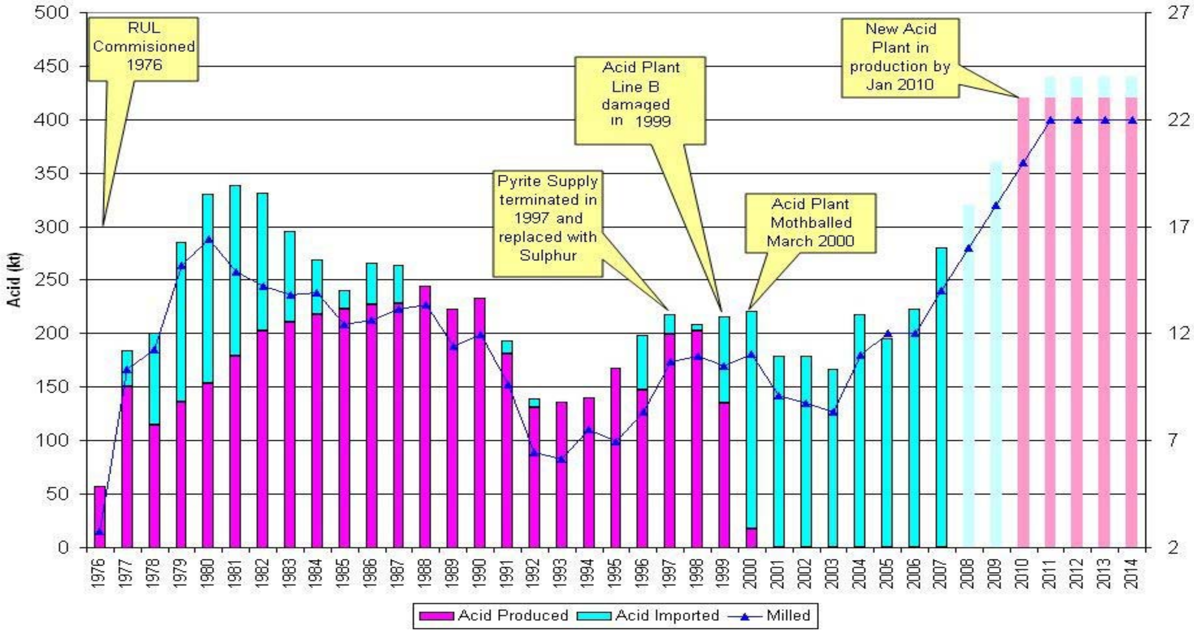

Figure 7: RU's acid production since 1976 (source: RU)

b) The proposed sulphuric acid production process at RU

Figure 9 provides a plan view of the sulphuric acid production plant proposed for RU. In essence, the sulphuric acid produced will be converted from elemental sulphur feedstock that is shipped to Walvis Bay harbour and railed to the proposed acid plant on the mine. Figure 10 is a diagrammatic illustration of the process flows of acid production.

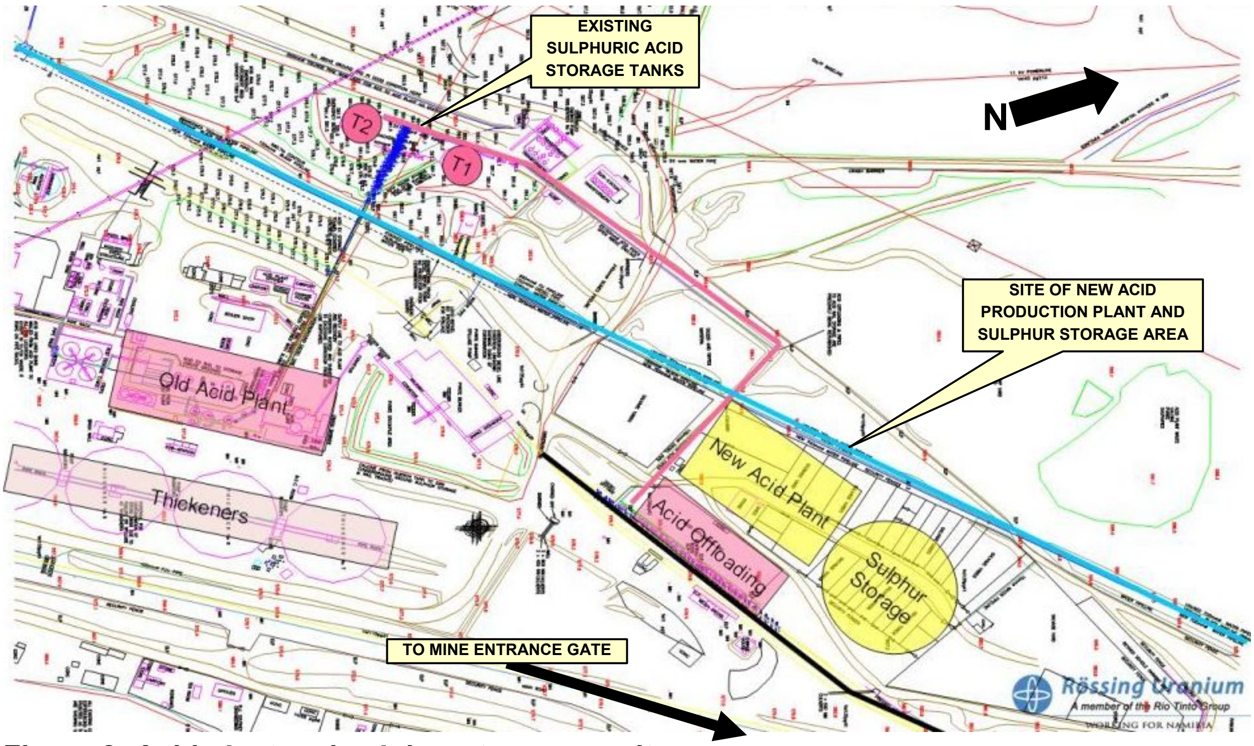

Figure 8: Acid plant and sulphur storage on site
(source: Rio Tinto : Acid Plant Feasibility Study - Update, Dec 2007)

The sulphuric acid production process as proposed for RU and is generally favoured as the most stable process with the highest yield of product. This correlates well with a preferred environmental option as this efficient and more stable combustion is associated with more manageable, predictable and measurable atmospheric outputs. The exothermic nature of the process also provides the opportunity for electricity generation by utilising the waste heat in the form of steam to drive a turbine generator. In the order of 10 MW of electricity (net) may be generated in this way, resulting in a positive contribution to RU's energy balance. A generic description of the process is now provided.

The manufacture of sulphuric acid at RU would be done via a two-step oxidation process of elemental sulphur (S) to sulphur trioxide (SO_3) which would be absorbed into a 98.5% sulphuric acid solution (H_2SO_4) as shown below in the process flow diagram in Figure 10.

From the sulphur storage the sulphur would be conveyed to the sulphur melting tank, where the solid sulphur would be melted at a temperature of approximately 145 °C with 700 kPa steam. The molten sulphur would then be filtered to remove any solid particles and transferred into the clean sulphur storage tank where the sulphur would be kept molten at approximately 145°C.

The molten sulphur would flow by gravity to the clean sulphur pit from where it would be pumped to the sulphur burner. In the sulphur burner, the molten sulphur would be combusted with dry air to form sulphur dioxide according to the chemical equation below

$$S \quad + \quad O_2 \quad \rightarrow \quad SO_2 \qquad \Delta H_{rxn} \text{ -ve}$$

The reaction is exothermic and the exit SO_2 gas at 1131 °C. and 48 kPa would be cooled to 420 °C in a waste heat boiler prior to entering the converter. The function of the converter is to oxidise the SO^2 to SO_3 using a vanadium pentoxide catalyst according to the equation below

$$SO_2 \quad + \quad \tfrac{1}{2}\, O_2 \quad \rightarrow \quad SO_3 \ \Delta Hrxn \text{ -ve}$$

The SO_3 formed in the converter is absorbed into 98.5% sulphuric acid via a 2 stage absorption system according to the equation below

$$SO_3 \quad + \quad H_2O \quad \rightarrow \quad H_2SO_4 \qquad \Delta Hrxn \text{ -ve}$$

The gas leaving the final absorption column, containing 250 parts per million (ppm) of SO_2 under routine operating conditions, would be vented to atmosphere via a stack. The stack would be a self supported steel stack 50 m tall and would have a diameter of about 2 m.

The Scoping Report of November 2007 refers to air cooling as the preferred option at that stage in the acid plant design formulation. However, RU has subsequently made a strategic decision to use water cooling for both the acid plant and turbine generator set. This decision is based on the assumption that NamWater will install a regional desalination plant and thus be able to provide RU with the additional water required for the acid plant as well as the other expansion project water needs.

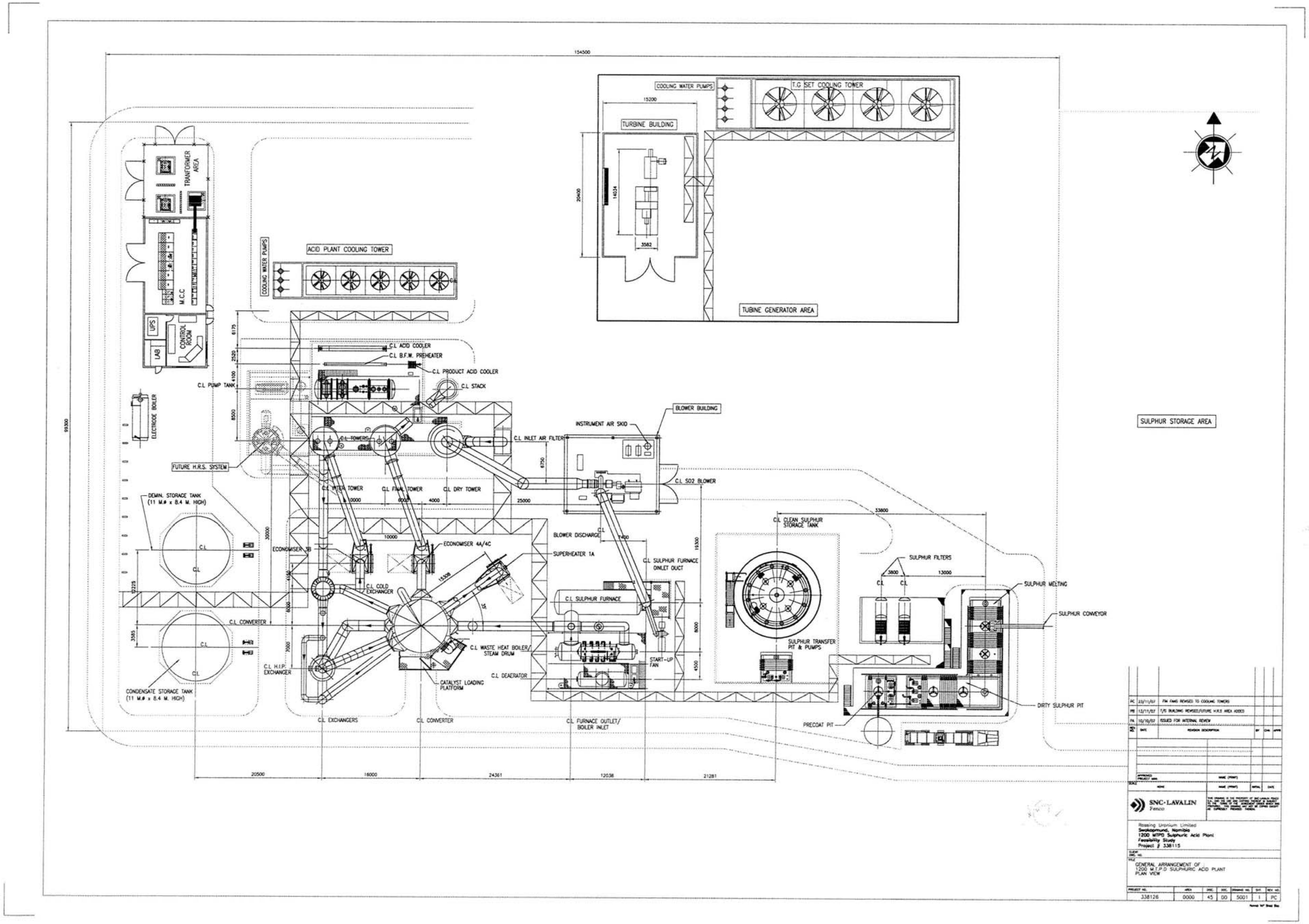

Figure 9: Plan view of the proposed sulphuric acid plant (source: SNC-Lavalin Fenco)

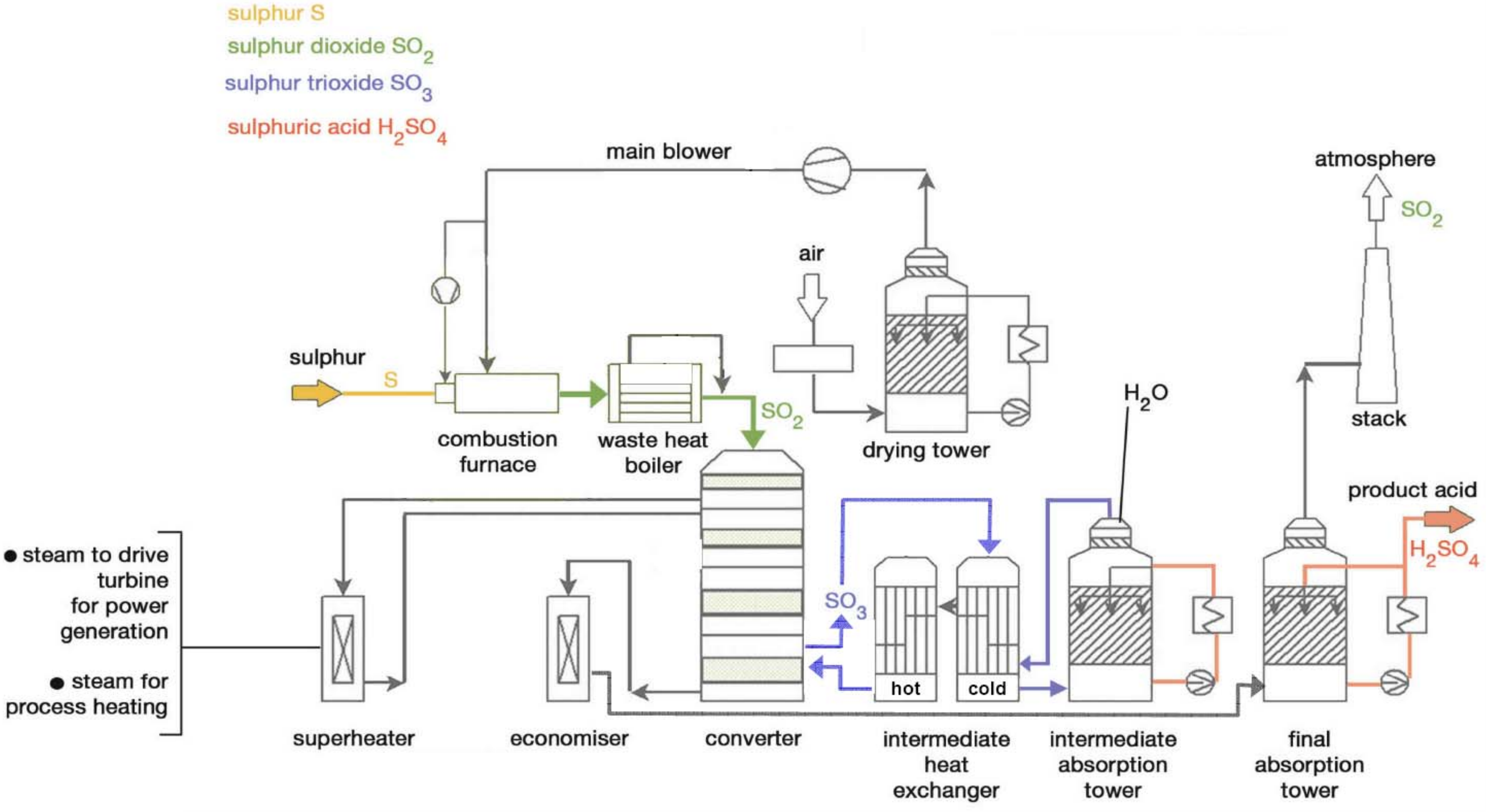

Figure 10: Diagrammatic illustration of the process flows of the proposed sulphuric acid plant
(source: modified from RU Public Participation Material, 2007)

The options that were examined included using waste heat for process purposes only, for both electricity generation and process purposes, or for electricity generation only. Water cooling for the acid plant and turbine generator set will have the benefit of maximising the waste heat and thus generating the most electricity at the least cost. From an environmental perspective, therefore, water cooling is acceptable since it is a case of the best available technology and environmental option being applied. It also highlights the importance of the cumulative implications of an enhanced water supply as a shared regional resource.

This plant will be constructed using best international practice, as recommended in the feasibility report prepared by SNC-Lavalin Fenco (2007), and will contain the required concrete bunding and sealed barriers to prevent any spill movement. The acid plant will produce 1 200 tpd of sulphuric acid at approximately 98.5% efficiency rate. The SO_2 to SO_3 conversion efficiency is likely to be in the order of 99.7%.

The sulphuric acid thus produced will be piped to the two existing storage tanks (see T1 and T2 in Figure 8), ready for use in the plant. These tanks each have a capacity of 15 000 t, giving a total storage volume of 30 000 t of sulphuric acid on the mine.

c) Primary product rail transportation and handling on site

The elemental sulphur will be in the form of “prills” (pellets) delivered to the site via rail and stored in an enclosed storage area containing the requisite fire detection and control equipment. This area of responsibility will form part of RU’s ongoing operational occupational health and safety protocols and procedures.

The sulphur will be transported from Walvis Bay to the mine site in approximately 25 side-tipping railcars, each of 42 t capacity, that can be securely closed and thus ensure zero spillage. There is an existing railway line between Walvis Bay and the mine which is currently well-used for transporting sulphuric acid to the mine. Three trains per week are envisaged, delivering 1 050 t each, thus allowing for the 400 t per day required by the acid plant. The management of impacts and operational protocol along this route is thus well established. The transportation of elemental sulphur to the mine will be outsourced to TransNamib, although the railcars will be owned by RU. An important feature of the transport of sulphur from Walvis Bay to the mine is that the railcars are specifically designed for the purpose, i.e. they will be completely sealed when in use and the possibility of spillage will be insignificant. From an environmental perspective, therefore, the best available technology and environmental option has been applied.

Up to 10 000 t of sulphur will be stockpiled at the mine, allowing for a supply period of 25 days. The proposed stockpile site is adjacent to the acid plant (see Figure 8), and an appropriate stacking conveyor and reclaim loader and hopper will be installed. The stockpile will be in the open on an asphalt pad, provided with bund walls and surrounded by a synthetic wind fence on three sides. A front-end loader will be used to transport the sulphur from the stockpile to the reclaim loader and hopper.

2.1.2 Radiometric ore sorter plant and associated reject rock disposal

a) Context

RU has a long history of involvement with radiometric sorting dating back to exploration test-work in 1968 and the mine currently uses truck scanners for final grade control. Studies during the 1970s concluded that radiometric sorting in the plant would only make economic sense by increasing production levels but until recently the uranium market has not been conducive to this. In the mid 1990s however, newer, more efficient sorter technology made sorting viable at constant rates of production and in 1998 RU approved the construction of a single-sorter pilot plant.

During 2001 the pilot plant was commissioned and test-work began and ran until 2003. Due to poor market conditions and the prospect of closure during 2003/04, the ore-sorter was not operational but started up again in 2005. In mid 2005 approval was granted to tie ore sorting into the fine crushing plant as a production plant and capital was spent on the installation of a waste conveyor. During the period May to December 2006 a total of about 60 000 t of ore was fed to the crusher of which a sizeable portion was rejected to waste which confirmed that ore-sorting at RU is technically feasible.

An environmental impact assessment for a production scale ore sorting plant at Rössing was completed in March 2002. The study concluded that the occupational health hazards associated with the potential production ore sorter would be very similar to those already identified for the fine crushing and pilot ore sorting plants. Occupational risks on the production plant itself were found to likely be low as a result of minimal operator presence on the plant, especially under load. However, the production ore sorter's contribution to occupational risk within the whole fine crushing area would likely be more significant.

It was predicted that, as a result of ore sorting, high silica content rock types in feed ore would reduce, thus decreasing the impact of silica dust. With a production ore-sorting plant in place, the average uranium grade through the process would increase. A marginal increase of the annual average radiation dose attributed to dust was expected. However, the total radiation dose to employees in the processing plant was expected to remain well below the RU standard based on International Council for Radiological Protection (ICRP) recommendations. Similarly, the radiological hazard from the disposal of rejected low grade ore is expected to be well within the ICRP recommended limits.

The ore sorting production plant was predicted to be a source of noise. However, the largest environmental impact associated with construction and operation of the ore sorter production plant would be the deposition of the reject material. In the original work, the possible sites with the least potential impact on the environment were identified as the top of the tailings dam or a site between the southern toe of the tailings dam and the fine crushing plant.

The conclusions in respect of a suitable dumping site were reviewed by in-house consultants in 2005. Considering the low waste volume which was related to the production plans prior to mine life extension, two further disposal sites were identified.

Since the extension to the life of mine and the intention to increase production capacity has been approved, the radiometric ore sorting plant is again seen as an important contributor to achieving the desired increase in throughput and uranium production.

A new pre-screening plant, replacing the existing one, drawing material from the coarse ore stockpile, is proposed to be constructed as part of the project to provide the material for sorting.

Specific size fractions will be scalped off in the pre-screening plant and the remaining size fraction will be processed using the radiometric ore sorters to provide an "accept" stream and a "reject" stream. The accept stream contains ore above the selected uranium grade and conversely the reject stream contains waste. The existing 500 t coarse ore bin will be reconfigured (or replaced) to increase its capacity and to feed the secondary crushers. The proposed plant is to be positioned within the current operations of the Rössing mine on the west side of the reclaim conveyor from the coarse ore stockpile. See Figure 11. Geotechnical data will confirm this as a suitable location from a stability perspective.

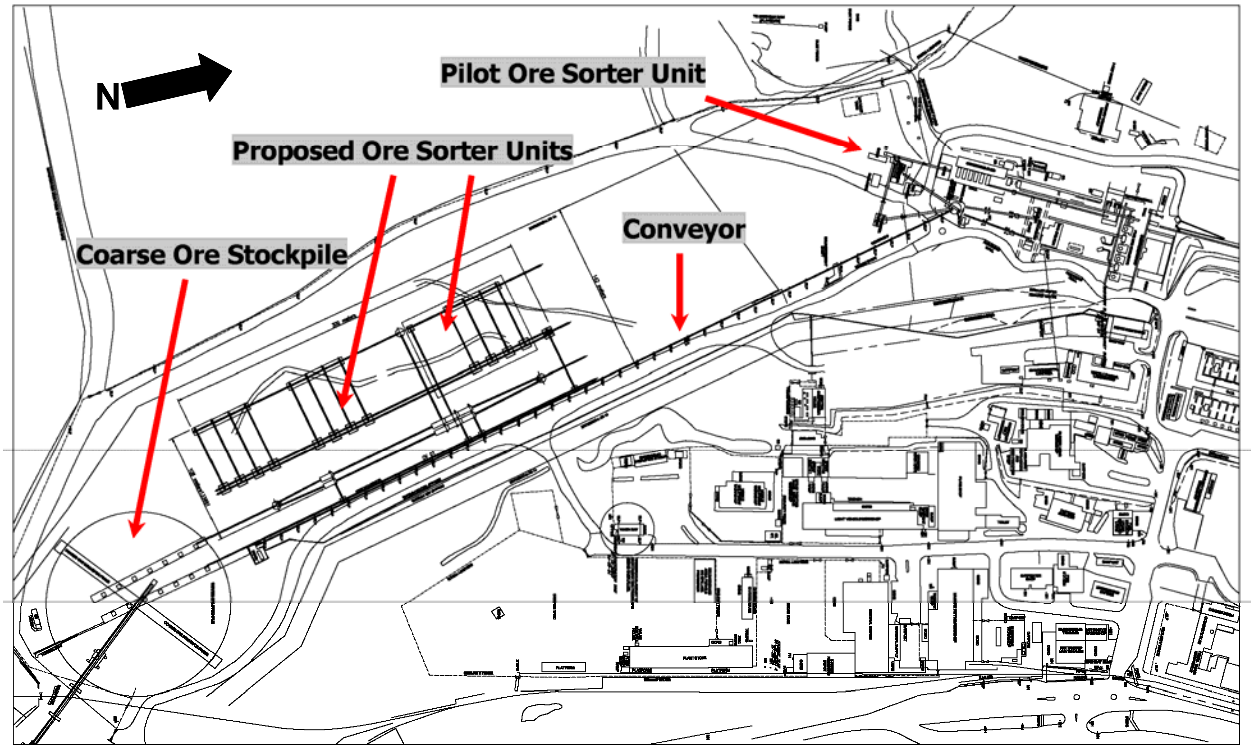

Figure 11: Location and layout of proposed ore sorter units (source: Bateman Africa)

<u>In summary, the following sequence of actions would be undertaken for the operation of the proposed radiometric ore sorter:</u>

- <u>The ore/waste mix from the open pit would move through the primary crusher and be pre-screened to divert a fraction of the total load to the ore sorter;</u>

- After sorting, a fraction of the load would re-enter the crushing and milling sequence before leaching and processing of the final product; and
- The rejected fraction of the load would be sent for disposal as waste rock.

The engineering work for the project would entail construction of systems for ore reclaiming from the coarse ore stockpile, the pre screening plant, the production ore sorting plant, waste handling, and rejection of material to the nominated waste storage area and tie-in for all equipment into the current operation. It would include provision of various facilities, including maintenance, warehouse, control room, compressed air, on site utility distribution (water, electricity etc) and identification of lay down areas required for construction.

Findings of previous environmental assessments have indicated that there will be no major adverse impacts from the construction and operation of a radiometric ore sorter plant. The radiological hazard is expected to be well below the ICRP recommended limits. Completed studies have shown that noise levels and airborne dust emissions will be maintained below the maximum permissible exposure levels for the area. However the area will be demarcated as requiring personal hearing and breathing protection as a safe guard for personnel.

b) Construction and process specifics

The concept for production radiometric ore sorting is to install between eight and ten sorter units after the pre-screening plant and ahead of the fine crushing plant. The ore sorters will remove individual rocks below a set U_3O_8 grade from the feed stream using radiometric detection and compressed air ejection, resulting in a high-grade stream and a waste stream as described previously. The high-grade stream will be returned to the pre-screening plant coarse ore stream via conveyor, and the waste stream will be conveyed from the ore sorting machine to an identified waste rock disposal site as described in Sections 2.2.2 and 5.4.6.

Ore will be fed onto the ore-sorting machine via vibrating feeders and vibrating screens. An existing pilot plant is present on site. Note that the production sorting plant will be located some distance to the southwest of the pilot plant and that the pilot plant unit will be incorporated into the new production sorting plant. The machine's design combines a mechanical feed with a rock radiation measuring device and an optical rock profiling system. As mentioned, the rocks will be sorted on an "accept" and "reject" basis dependent upon the radiation content. Compressors will be installed to provide compressed air for the air blast chambers of the ore-sorting machine. In addition, a dust extraction system will be installed to control dust at all transfer points as well as the ore sorting machine and air blast chambers, in accordance with best environmental practice.

The ore sorting production plant would be interfaced with the site process control and be operated remotely, resulting in low labour requirements.

c) Environmental advantages of the proposed ore sorting plant

The following summarises the economic and environmental advantages of an ore sorting plant versus more conventional methods of increasing processing volume:

- An ore sorting process is a logical extension to the truck scanning process, allowing for an increased proportion of mill feed to be scanned. This has advantages in terms of reducing the need for infrastructure and the volume of vehicular traffic that needs to move on the mine, with a resultant reduction of dust and exhaust emissions.
- High grade ore with a high calc. index, low grade ore and even waste ore may become economical to process with the installation of an ore sorting plant, resulting in increased efficiencies in the metallurgical process.
- Although sorting may not reduce the acid consumption per tonne of ore leached, acid used per unit of U_3O_8 produced will be reduced as less tonnes of ore will need to be leached. This has directly beneficial impacts in terms of tailings produced and acid volumes utilised.
- Sorting does show a major cost benefit in the form of savings from variable costs as a result of less tonnes of ore being processed. Such savings also result from a reduction in the use of both fresh water and power consumption. Given the volume of water use and RU's location in an arid environment, as well as the operation's draw on the power grid, these reductions would be welcome from a sustainability perspective.

2.1.3 Development of the SK4 ore body

a) Context

During earlier geological exploration undertaken in RU's mining license area, two other areas of potentially viable ore besides the active SJ pit were identified. These are referred to as the SH and SK anomalies[10] and are located within three kilometres to the southwest and northeast of the SJ pit respectively. See Figure 12.

The SK anomaly is of particular importance. It contains a smaller area of ore grades that are significantly higher than the active SJ pit, known as SK4. Besides the economic motivation presented by the increase in uranium prices on the international market in recent years, exploitation of the SK4 ore body would supplement the lower grade ore currently processed by RU.

Since the exploitation of SK4 may be seen as an augmentation rather than an expansion of existing operations, RU initially adopted the approach that an amendment to the EMP already in place would satisfy the social and environmental obligations necessitated by mining SK4. Although this approach was acceptable to the responsible authorities, and a draft EMP for the extension of mining activities into the SK4 area was prepared (Rössing Uranium, 2007), RU has subsequently decided to subject the proposed development to comprehensive environmental assessment. This was motivated by their recognition that the conservation status of the invertebrate fauna extant in the SK area is not well enough understood to allow for environmental decision-making. Adopting this approach is in accordance with RU's adherence to the precautionary principle in environmental management.

[10] Both the SH and SK anomalies are proposed for eventual mining and an SEIA to seek environmental approval for their exploitation will follow as Phase 2 of RU's expansion project. See Section 1.1 above in this regard.

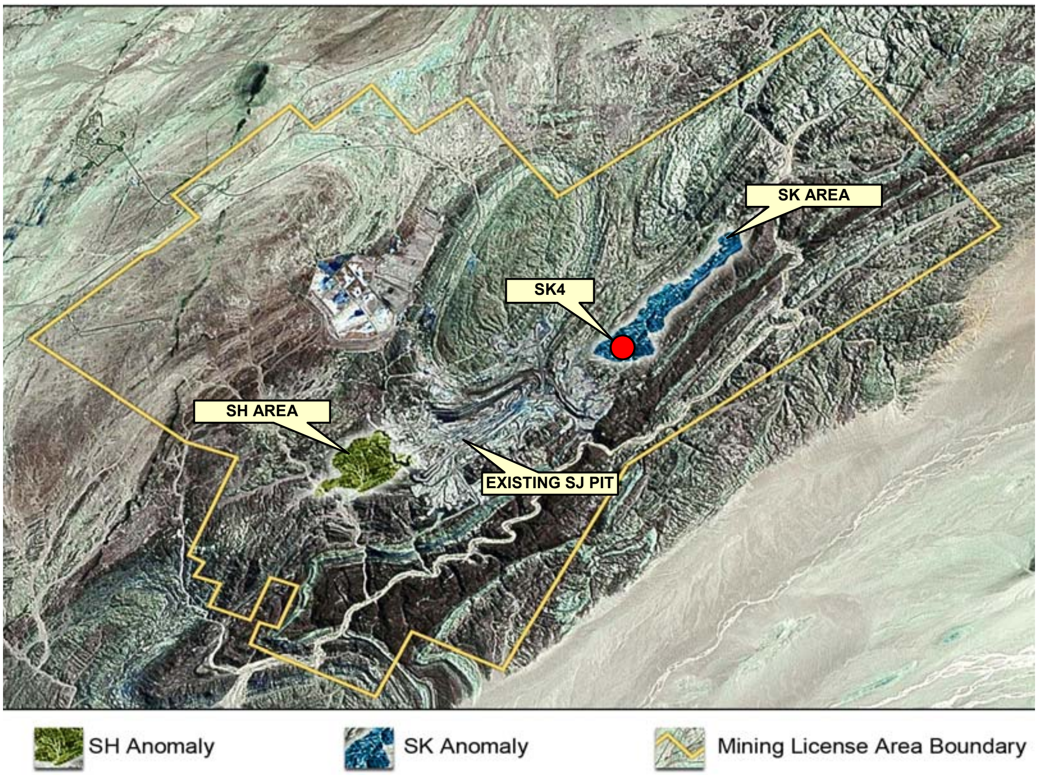

Figure 12: Location of SH and SK anomalies (source: RU)

As a consequence of RU's adopting the precautionary principle, the proposed mining of the SK4 ore body is being subjected to comprehensive environmental assessment by being included as one of the components of the present SEIA for Phase 1 of the expansion project.

b) Method and extent of mining

The typical open pit mining sequence of drilling, blasting, loading and haulage will be applied at SK4.

The pioneering work required to allow access to the SK4 site would comprise drilling, some minor blasting and the use of heavy earth moving plant. Once suitable road access has been created, excavation will be undertaken to provide a drilling platform. The drilling platform will then allow the initial excavation of two 15 m deep benches and access by loading equipment. Various types of heavy equipment will be put to use on the site, including an excavator and dump trucks, supported by a bulldozer and front-end loader. A water cart for dust suppression and a diesel bowser for refuelling will also be available.

It is envisaged that the SK4 pit will eventually comprise about 10 benches, in an excavation of 600 m in length, 300 m in width and 140 m in depth (see Figure 13). Its exposed surface area would thus eventually comprise in the order of 43.2 ha. The life of the SK4 ore body mine is anticipated to be approximately three years.

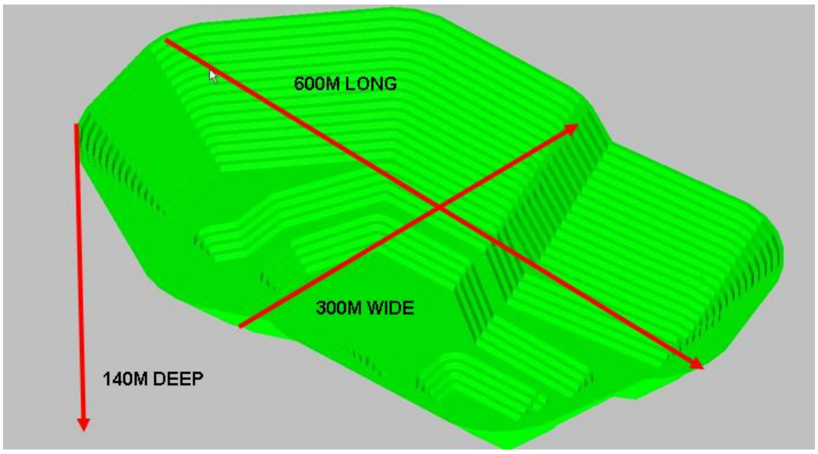

Figure 13: Dimensions of SK4 pit (source: RU)

c) Haulage, processing, waste disposal and infrastructure

A single haulage road of some 35 m in width is envisaged, accessing the SK4 pit in the south-western corner. This dedicated haulage road will continue to the existing primary crusher which is situated 3.5 km to the northwest of the SK4 pit. Figure 14 provides an indication of the route of the haul road and it should be noted that the infilling of several small drainage lines will be necessary to accommodate the road alignment. Although this infilling will result in an intrusion into the landscape, its low elevation and the already transformed nature of the surrounding biophysical environment will be such that the impact of this section of the haul road will not be significant. The material from the SK4 pit will then continue in the ore stream, to be processed in the normal fashion through the existing metallurgical plant.

The waste rock (±20 Mt) derived from the SK4 pit will be accommodated within existing waste dump sites and an area designated as *Waste 7* has been earmarked for this purpose. Although this waste dump site offers sufficient capacity to hold the waste ore from the SK4 pit, the longer term implications of visual intrusion on elevated horizontal lines in the landscape have been considered, as reported in Section 5.5.3.

Water will be required for drilling activities and dust suppression in the SK4 pit. The current rate of water usage for these purposes for the entire mine operation is about 700 m^3/day. This figure is likely to double with the exploitation of the SK4 ore body and expansion of the mining activities in the active SJ pit.

Groundwater is presently abstracted from the Khan River for use in dust suppression and this source provides about 600 m^3/day. A water reservoir in the waste rock disposal area designated *Waste 4* will provide the necessary water for SK4. This pond is fed by water from the Khan River source and it is intended to increase its volume by supplementation from plant runoff from Boulder Gorge and treated effluent from the waste water treatment works. The supply of water to the SK4 pit is thus an integrated element of the management of water for the entire mining, processing and waste disposal operation.

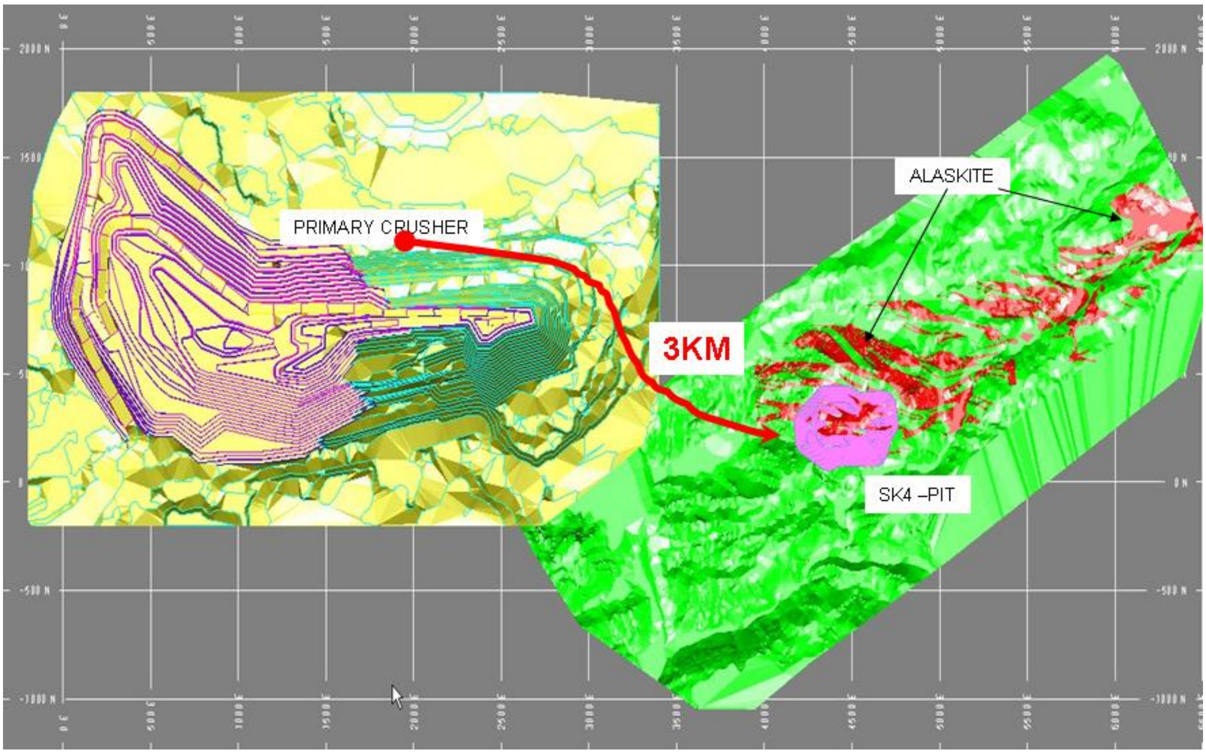

Figure 14: Indication of alignment of the SK4 haul road (source: RU)

Water will be provided for the SK4 mining activity, but no electricity will be brought to the site. The principle of optimising linear infrastructure within existing or planned utility corridors will be applied, meaning that the dedicated haulage road would in all likelihood also provide the route for the water supply.

2.2 CONSIDERATION OF ALTERNATIVES

The identification and consideration of alternatives is recognised as required practice in environmental assessment procedures globally. Regulatory requirements in Namibia accord with this requirement, as reflected in the Environmental Assessment Policy, namely as a step in the earliest proposal development stage[11].

Alternatives are typically considered at various stages in the formulation of proposed developmental policies, plans and projects. With reference to development policies and plans, these are usually addressed at the higher level of national and regional strategy and forward-planning, and are termed strategic alternatives. As far as project alternatives are concerned, their assessment is limited to the level or site of the particular project. The examination of alternatives for RU's proposed expansion project is thus only concerned with the assessment of project-level alternatives. It was these alternatives that were put forward and described in the Scoping Report of November 2007. Part of the Scoping process is to screen out those alternatives that will not be considered in the SEIA Report stage. Unless there is valid and

[11] See Section 3 of Appendix A of the policy.

logical justification to screen them out, all feasible alternatives should be considered in the SEIA Report stage.

During the present SEIA Report stage, each of the selected alternatives has been assessed in terms of their potential impacts on the socio-economic and biophysical environment. The formulation of mitigation measures to reduce the significance of negative impacts is a key part of the assessment process. In deriving mitigation measures, process modifications to the preferred alternatives may be made.

At the end of the SEIA process, RU would be able consider the assessment of the alternatives described in this section, together with any mitigation measures that are proposed, to select the preferred options to submit to MET:DEA for their clearance.

2.2.1 Strategic alternatives

As contextualised in the previous section, strategic alternatives refer to those alternatives that were considered at a higher level than this project-level SEIA. In this case, and as described in Section 1.2 above, the Constitution of the Republic of Namibia, Vision 2030, the Environmental Assessment and Management Act and RU's Sustainabilty Assessment provide the overarching policy and planning framework within which RU's strategic decisions have been made. The present SEIA is thus part of the re-evaluation of the life of the Rössing uranium mine, beyond the present target date of 2016, in terms of overall feasibility, i.e. including social and environmental criteria.

There is also a requirement in terms of environmental best practice to examine the alternative of maintaining the *status quo*. This refers to the situation that would pertain if no development were to occur. In the case of the present SEIA process, this option would amount to the Rössing uranium mine closing in 2016. With the current opportunity of deriving strategic, economic and social benefit from prolonging the life of the mine, not taking up this potential opportunity is considered to be an unattractive alternative. As a result, the *status quo* alternative has not being evaluated at the same level of comparative detail that the project alternatives reflected in this report are. Rather, the *status quo* forms the baseline against which potential positive and negative social and environmental impacts of RU's proposed expansion project are assessed.

2.2.2 Project-level alternatives

a) Sulphuric acid plant and associated handling, storage and transport

<u>It should be noted that RU's approach has been to identify and specify the best available technology in the design formulation of the acid plant and associated infrastructure. SNC-Lavalin Fenco's *Feasibility Report for New Sulphuric Acid Plant* of December 2007 has been the primary informant in this regard, resulting in the most environmentally appropriate design being applied</u>.

Site

A site for the proposed sulphuric acid production plant on the mine has been identified, namely within an area presently used as the salvage yard[12]. See Figure 8. A decommissioned[13] acid plant is in existence in the same general area but its intended dismantling and removal will later be subjected to the required occupational health and safety prescriptions, which will include the decontamination of polluted substrate. Although the timing of the removal of the redundant acid plant forecloses on utilising the same site for the proposed new acid plant, the severely changed nature of the area, within the transformed, brownfield mine processing precinct, means that there is no lost opportunity from an environmental perspective. Nevertheless, the exact location and orientation of the proposed acid plant within the greater salvage yard area will be subjected to technical and economic optimisation insofar as the human health, engineering cost and infrastructure integration are concerned. Due to practical considerations related to existing infrastructure, no array of alternatives that would bring significant environmental benefit is thus available. Adherence to best practice will be satisfactory in the siting of the proposed acid plant on the mine.

The manufacture of sulphuric acid requires elemental sulphur feedstock and this would have to be imported via the Port of Walvis Bay and transported to and stored at the proposed sulphuric acid production plant on the Rössing mine. The situation relating to sulphur handling and storage in the Walvis Bay harbour has had to be excluded from the present assessment process, as described in Section 1.5, due to RU looking at ways to retain full control of the proposed sulphur handling and storage facility, rather than vesting some or all of this control to Grindrod, the operators of the bulk handling terminal, as initially envisaged. RU are therefore investigating alternative sites and if any of these look more attractive, will initiate a separate assessment process for their own sulphur handling and storage facility in the harbour, possibly also using land already leased to them for sulphuric acid handling and storage for the purpose.

Handling, storage and transport

Given that the sulphur handling and storage in the Port of Walvis Bay has been excluded from the present SEIA, this assessment commences at the point at which it is loaded onto the railcars in the harbour for transport to the mine. Nevertheless, the assumption is made that such handling and storage, once approved, will primarily accord with globally recognised best practice. Since the activities would occur within an industrial precinct, it is unlikely that an array of alternatives will need to be examined in this regard. By the same token, the handling and storage of sulphur in proximity to the acid plant on the mine also does not present site or technological alternatives, since the proposed site is already severely transformed and appropriate engineering design and operational best practice have been applied.

The transportation of the sulphur by rail to an offloading and storage facility in the vicinity of the acid plant on the mine will require purpose-designed railcars. These have already been specified by RU and accord with best practice in this regard. See 2.1.1 c) above.

[12] Note that the site includes space for the handling and storage of sulphur feedstock.
[13] March 2000.

With reference to the storage of sulphuric acid produced by the proposed acid plant, prior to its application in the metallurgical process for the leaching of the pulped ore, this will occur in two existing tanks of 15 000 t each, designed for the purpose.

Technological alternatives

The most recent outcome of the various orders of magnitude and feasibility studies undertaken or commissioned by RU regarding the optimum and most appropriate technology to apply in the proposed acid plant is SNC-Lavalin Fenco's *Feasibility Report for New Sulphuric Acid Plant* of December 2007. Several options were investigated in this report, ranging from a base case of sulphuric acid production at the rate of 1 200 t/d with power generated from the excess heat, to other options of differing production capacities and use of excess heat. The preferred option from a technological point of view that has emerged from this study is per their base case and with water cooling for both the acid plant and the turbine generator set, as described in Section 2.1.1. The base case is subjected to review in Chapter 5 below, to confirm that socio-economic and biophysical issues would not necessitate a revision of the technological preference.

As far as the optimal emission stack height of the acid plant is concerned, this has been largely informed by the outcomes of the air dispersion modelling described in Chapter 5. A stack height of 50 m appears to be acceptable, based on the need to avoid risk to human health.

b) Radiometric ore sorter plant and associated reject rock disposal

It should again be noted that RU's approach has been to identify and specify the best available technology in the design formulation of the ore sorter and associated infrastructure. The primary informants in this regard have been the specification of fugitive dust capture and noise control measures, which have resulted in the most environmentally appropriate design being applied in this case.

Site

A site for the proposed radiometric ore sorter plant has been identified in the area west of the conveyor running between the existing coarse ore stockpile and the series of crushers and screens where the present pilot ore sorter plant is located. See Figure 11. Since the area is within a largely transformed space between the mining operations and the processing plant, and contains various linear utilities, the technical and engineering criteria that informed the choice of site has not needed to be influenced by environmental concerns.

Technology and design

The technology employed to radiometrically select higher grade ore from the ore stream is sophisticated. Given that such technologies represent leading-edge science and that research is continually being undertaken to advance the technology, their application is such that a variety of alternative technologies is not available.

During preliminary investigations, the arrangement of the pre-screening units, which may have been positioned vertically, i.e. stacked one above the other, or horizontally, i.e. in series at the same level, presented possible alternatives. However, since sufficient physical space is available for the horizontal arrangement, which also has benefits from engineering cost and visual intrusion perspectives, the vertical arrangement is no longer being considered as an alternative.

The nature of the transportation, screening and sorting of ore results in considerable noise and dust impacts. The compressed air pneumatics that separate the accept and reject rock streams, and the discharge points of conveyors, are two particular cases in point of sources of noise and dust respectively. Although these impacts will be subjected to mitigation as far as is technologically and economically feasible, the primary criterion will be the meeting of applicable occupational and public health and safety standards. The mitigation measures of noise attenuation and fugitive dust capture have been subjected to environmental review rather than treated as alternatives, since they are a means of achieving acceptable levels of mitigation.

Reject rock disposal sites

RU has in the past undertaken various studies to identify possible sites for the disposal of the reject rock from the proposed radiometric sorting process. The most recent of these studies (Rio Tinto Technical Services, 2005) addressed seven possible locations, illustrated in Figure 15 below, as follows:

- Location A ~ The tailings dam;
- Location B ~ Below the southern toe of the tailings dam;
- Location C ~ The valley and areas adjacent to the grit-blasting yard;
- Location D ~ The mine waste dump designated *Waste 5*;
- Location E ~ The upper area of Dome Gorge;
- Location F ~ Northwest of the salvage yard on the slopes of the Berning Range; and
- Location G ~ South of the Seepage Dam access road.

However, certain of these locations are inherently flawed or have significant constraints. This is due to their impacting on the management of the tailings dam and its seepage (Locations A and B), limiting the exploitation of ore (areas within Locations D and G), foreclosing on possible sites for heap leaching (Location E), or posing infrastructural and visual impacts (Location F).

The possibility of utilising existing, designated waste rock disposal areas is also being kept as an option. These alternatives are the subject of an evaluation, as described in Chapter 5.

Figure 15: Location of the initial reject rock disposal sites (source: RU)

c) Mining of the SK4 ore body

Given that the development and exploitation of the SK4 ore body would essentially comprise an extension of present mining activities within RU's allocated mining licence area, the availability of alternatives is limited. The envisaged method of mining, as described *inter alia* in Section 2.1.3, accords with current and approved practice on the Rössing mine and, as such, may be regarded as acceptable practice. There are certainly no feasible alternatives available insofar as geographical location and mining methodology are concerned. The ore derived from SK4 would be subjected to the current metallurgical beneficiation process[14] applied on the mine, further limiting the availability of alternatives during the exploitation of the ore body.

Environmental controls required during the exploitation of the SK4 ore body would be based on mitigation measures and operational management practices currently in place on the mine. These comprise the occupational health and safety issues of noise, dust and radiation management and monitoring, and the socio-economic and biophysical issues of hydrology, heritage, biodiversity, visual and human resources impact management.

The Scoping Report of November 2007 referred to three issues related to SK4 that could possibly have required the assessment of alternatives. These were the final formulation of the design and geometry of the haul road alignment, the ability of current waste disposal sites to

[14] As opposed to the ore eventually derived from the SH ore body, which would require a different metallurgical beneficiation process should it be exploited in the future.

accommodate the envisaged waste rock, and the means by which water for dust suppression and drilling are sourced and their runoff managed. It was also noted in the report that engineering design refinement and finalisation of elements of the SK4 mining operation had yet to occur and that the SEIA stage of the process would provide an opportunity to incorporate new and/or additional information. This has indeed come about and appropriate mitigatory measures and design criteria have informed the refinement and finalisation of the haul road, waste disposal and water management. These issues are the subject of environmental review in Chapter 5, rather than being treated as alternatives, since they are a means of achieving acceptable levels of environmental management.

d) Other project level alternatives

The previous three sections have dealt with the acid plant, ore sorter and SK4 mining in particular. However, there are several potential environmental impacts that cut across the entire Phase 1 SEIA. These mainly relate to socio-economic issues that are common to the specific components of the expansion project. These are now briefly described insofar as possible alternatives may be available.

Housing for additional permanent employees and temporary construction workers would be required. The decision with regard to the siting of the temporary construction camp/s may benefit from the consideration of possible mitigation measures in terms of location and service provision.

The socio-economic study that is a component of this SEIA, undertaken by Marie Hoadley, has suggested the following alternatives for the housing of construction workers:

- "House the construction workers in Arandis in permanent free-standing houses which can, on completion of the construction phase, provide housing for RU permanent employees and other residents of Arandis.
- Identify the owners of the farms situated to the north-east of RU and negotiate with them to establish the possibility of a lease over a portion of the farms for the erection of a construction camp.
- Build houses in the Progressive Development Area in Swakopmund and sell these on completion of construction, either to RU employees or on the open market."

The socio-economic study has suggested the following alternatives for housing additional permanent RU employees:

- "House the majority of the workers in Arandis and the more senior level employees who can afford more expensive accommodation in Swakopmund.
- House the majority of the workers in Swakopmund and/or Walvis Bay and supply housing in Arandis to those employees who indicate that they want to live there."

The availability and adequacy of social services such as schools and medical care, to accommodate the increase in the numbers of employees, need to be examined. The socio-economic study has suggested the following alternatives for schooling for the children of RU employees:

- “Build extra classrooms at existing schools.
- Build a new school, in collaboration (through the Chamber of Mines of Namibia) with other mining companies, and hand the school over to the Ministry of Education on closure.
- Build a hostel in Arandis, to be run by the Rössing Foundation.
- Lobby government (through the Chamber of Mines of Namibia) to build new schools, either in Swakopmund, Walvis Bay or both.”

Another related issue is the capacity of existing infrastructure services such as domestic water supply, waste management, electricity supply and transport services to accommodate the increased demand. The degree to which the provision of these services can be examined in the present SEIA process is dependent on regional resource availability and planning. This will require attention to off-site and cumulative impacts.

Also important in the regional context is the fact that several uranium mining developments are presently underway in the Erongo Region. Managing the social, infrastructure and resource issues mentioned above would benefit by a strategic or sectoral approach to their assessment. While the present SEIA addresses cumulative and sectoral impacts as far as possible at the project level, RU would require co-operation from national, regional and local authorities, interested stakeholders, and the other uranium mining companies, if a properly integrated approach is to be brought about. In this regard, it should be noted that the Chamber of Mines of Namibia has recently initiated a Strategic Environmental Assessment that addresses the mining sector in the Erongo Region in particular. RU’s continued involvement with the Chamber and collaboration with the Strategic Environmental Assessment is encouraged.

Due to the difficulty of addressing cumulative and sectoral impacts, the present SEIA process will be undertaken in an adaptable manner, to allow for new or additional information to be incorporated as the process continues.

e) Summary of available alternatives

A table that provided a summary of the project-level alternatives that were identified during the Scoping Stage appeared in the Scoping Report of November 2007. The intention was that these alternatives would be subjected to further assessment during the SEIA Stage of this assessment process. However, the revision of available alternatives described earlier in this section was the result of new information being made available or the scope of the SEIA changing. Consequently, the number of possible alternatives has changed or diminished and the following table reflects the revised situation.

Project component	Aspect
Radiometric ore sorter plant	Suitable disposal site for reject rock
Alternatives common to acid plant, ore sorter and SK4 mining	Housing construction workers
	Housing additional RU employees
	Additional schooling for children of RU employees

Table 1: Project-level alternatives to be carried forward into assessment stage

These aspects of the listed Phase 1 SEIA project components are subjected to the consideration and evaluation of alternatives reported in Chapter 5. The numerous aspects that do not have alternatives are nevertheless also assessed, by means of determining that acceptable levels of mitigation are available, or by confirming that the best available environmental design or practice is being applied.

2.3 POTENTIAL IMPACTS IDENTIFIED DURING THE SCOPING STAGE

The components of Phase 1 of RU's proposed expansion project are anticipated to impact on a range of socio-economic and biophysical aspects of the environment. One of the main purposes of the SEIA process is to understand the significance of these potential impacts and to determine if project alternatives are available that are more beneficial to the socio-economic and biophysical environment, or if the impacts can be minimised or mitigated to an acceptable level. This section of the SEIA Report identifies the full range of potential impacts and proposes which impacts should be considered in detail. It should be noted that the identification of the impacts described in Sections 2.3.1 to 2.3.4 have been derived from concerns raised during the public participation undertaken to date, as well as input from the project team and responsible RU personnel. Section 3.1 also describes the most noteworthy issues raised by I&APs in particular.

2.3.1 Construction phase impacts

These are impacts on the socio-economic and biophysical environment that would occur during the construction phases of the proposed acid plant, ore sorter and SK4 mine. They are inherently temporary in duration, but may have longer-lasting effects, e.g. the contamination of groundwater during construction could have effects that may last long after the construction phases are complete. Construction phase impacts could potentially include:

- Socio-economic impacts, e.g. temporary housing, temporary employment, in-migration of work seekers;
- Disturbance of biodiversity resources;
- Impacts on heritage sites;
- Impacts on water resources, namely groundwater occurrences;
- Management of materials required for construction or establishment;

- Increase in traffic volumes to the mine and in the vicinity of the construction sites;
- Windblown dust and concomitant release of radioactive materials from exposed substrate;
- Noise pollution and vibration; and
- Pollution from waste and other contaminants.

Based on the temporary duration of the construction phases and the fact that negative impacts of construction can generally be reliably predicted and mitigated, more attention is given to the operational phase impacts of the proposed Phase 1 components than to the construction phase impacts. This is certainly the case in this instance as, for example, construction phase impacts related to the extension of the ore sorting plant and construction of the new acid plant are regarded as low. These construction-related impacts can easily be accommodated within a generic Social and Environmental Management Plan (SEMP) and RU's own best practice.

However, wherever relevant, specialist studies have considered construction phase impacts, and in certain cases, are focussed on such impacts e.g. impacts on biodiversity resources are mainly construction phase impacts.

It should be noted that a comprehensive construction phase SEMP in draft form has been developed and its implementation will regulate and minimise the impacts during the construction phase. This construction specification SEMP has been developed as part of the SEIA Report phase and is included as Annexure A.

2.3.2 Operational phase impacts

Given their long term nature, operational phase impacts have come under close scrutiny in the SEIA stage of this assessment process, effectively prompted by the Scoping Report of November 2007. The specialist studies have identified and assessed the implications of these impacts and have included measures to minimise predicted impacts. The assessment of potential impacts will help to inform RU's selection of preferred alternatives or to confirm that the best available technologies have been identified and selected, and for these to be submitted to MET:DEA for their clearance. In turn, MET:DEA's decision on the environmental acceptability of the proposed project and the setting of any conditions will be informed by the assessment of alternatives and selection of technologies, together with the specialist studies, amongst other informants, contained in this SEIA Report.

It is normal practice that, should the proposed Phase 1 expansion be authorised, the development and implementation of an operational SEMP would be required. The operational SEMP is designed to mitigate negative impacts associated with the operational phase of the project and have been informed by the mitigation measures that have emerged from the SEIA process.

2.3.3 Socio-economic impacts common to all the project components

The issues that relate to the social and economic implications common to the construction and operation of the acid plant and associated infrastructure, the ore sorter and the mining of the SK4 ore body, are as follows:

- The extent of employment opportunities created as a consequence of the proposed developments, both for permanent and contracted workers;
- The occupational health and safety of workers, both permanent and contracted, including air pollution (emissions, dust, radioactivity), and noise;
- The public health and safety of surrounding communities and visitors to the area;
- The need for housing for temporary construction workers, i.e. the location and servicing of construction camps;
- The need for housing for the envisaged increase in employee numbers;
- The extent of commercial benefits for the local and regional economies;
- The in-migration of people seeking employment;
- The availability and adequacy of social services such as schools and medical care;
- The availability and adequacy of infrastructure services such as domestic water supply, waste management, electricity supply and transport services;
- The social ills and community health issues that may accompany in-migration of work seekers, the densification of settlements and unfulfilled expectations; and
- The implications for both local residents and tourists of the possible visibility and noise of the proposed developments.

The following list of impacts have been identified as significant from the description of issues above, and are assessed in Chapter 5:

- Economic sustainability of Arandis;
- Permanent employment creation;
- Public health and safety;
- Housing and accommodation;
- Local economies;
- Inward migration;
- Schooling; and
- Infrastructure.

2.3.4 Identified operational impacts per project component

a) Acid plant and associated handling, storage and transport

The following issues relate to the proposed acid plant and associated sulphur handling and storage:

- The location, engineering design, construction and operation of the bulk sulphur storage facility to be installed at the Rössing mine, including the occupational and public health and safety implications;
- The location, engineering design, construction and operation of the acid plant and associated infrastructure (pipework, storage tanks etc) to be installed at the Rössing mine;
- The operational implications of managing the occupational health of personnel and the proper handling of materials required for the running of the acid plant and associated infrastructure;
- The visual impact of the preferred site and associated infrastructure (pipework, storage tanks etc) for the acid plant at the Rössing mine;
- The energy balance resultant from the operation of an acid plant at the Rössing mine;
- The air emissions and consequent occupational and public health and safety implications resultant from the operation of an acid plant at the Rössing mine;
- The management and disposal of toxic and other waste generated by the operation of an acid plant and associated infrastructure at the Rössing mine; and
- The projected water consumption and management.

The following list of impacts have been identified as significant from the description of issues above, and are assessed in Chapter 5:

- Air quality;
- Human health;
- Visual impact;
- Water resources;
- Noise and vibration; and
- Energy use.

b) Radiometric ore sorter plant and associated reject rock disposal

The following issues relate to the ore sorter and reject rock disposal sites:

- The projected volume of reject rock material to be disposed of during the extended life of the mine insofar as disposal options are concerned;
- The potential impacts on occupational and public health and safety of the ore sorter and reject rock disposal site alternatives;

- The visual implications of the ore sorter and reject rock disposal site alternatives;
- The biodiversity implications of reject rock disposal site alternatives;
- The use of water for the ore sorter and associated infrastructure (conveyors, pre-screening units etc);
- A noise implications of the ore sorter and associated infrastructure (conveyors, pre-screening units etc); and
- A review of the energy balance resultant from the operation of the ore sorter and associated infrastructure (conveyors, pre-screening units etc).

The following list of impacts have been identified as significant from the description of issues above, and are assessed in Chapter 5:

- Air quality;
- Human health;
- Visual impact;
- Water resources;
- Noise and vibration;
- Reject rock disposal; and
- Energy use.

c) Mining of the SK4 ore body

The following issues relate to the mining of the SK4 ore body:

- The impacts of blasting, noise and vibration resultant from mining the SK4 ore body;
- The potential impacts on occupational and public health and safety of the mining of the SK4 ore body;
- The engineering design (alignment and geometry) of the haul road proposed for the SK4 pit, as well as other service infrastructure such as water supply;
- The disposal of waste rock during the life of the SK4;
- The potential impacts on occupational and public health and safety resultant from mining the SK4 ore body (dust, radiation and noise);
- The visual implications resultant from mining the SK4 ore body;
- The supply, storage, application, runoff and reuse of water necessitated by the mining of the SK4 ore body;
- The biodiversity impacts resultant from mining the SK4 ore body; and
- The energy balance resultant from mining the SK4 ore body (drilling, blasting, loading and hauling activities).

The following list of impacts have been identified as significant from the description of issues above, and are assessed in Chapter 5:

- Air quality;
- Human health;
- Visual impact;

- Water resources;
- Noise and vibration;
- Waste rock disposal;
- Biodiversity; and
- Energy use.

3 THE PUBLIC PARTICIPATION PROCESS

The purpose of this chapter is to describe the public participation undertaken to date, i.e. during the preceding Scoping Stage, to present a synopsis of the issues raised, the stakeholders identified and the participation opportunities related to the SEIA Stage. It also provides an indication of the way forward with the public participation process.

3.1 INTRODUCTION AND SYNOPSIS OF ISSUES

Engagement with the public and stakeholders interested in or affected by development proposals forms an integral component of the environmental assessment process. Thus, I&APs have an opportunity at various stages throughout the SEIA process to gain more knowledge about the proposed project, to provide input and to voice any issues of concern.

Stakeholders and I&APs had several opportunities to participate in the Scoping Stage of the present SEIA process and the useful inputs received are acknowledged. The following are the most noteworthy of the issues raised by I&APs to date, as derived from the stakeholder feedback forms provided in Annexure H of the Scoping Report of November 2007, as well as the Record of Stakeholder Issues compiled in response to the release of a draft version of this SEIA Report in January 2008 and included here as Annexure L:

- Employment opportunities;
- Workplace health and safety concerns, including air and water pollution and noise;
- Housing implications;
- Services such as schools, medical care and water availability;
- Effects on the regional and local economy, including tourism;
- Negative social impacts from newcomers seeking work;
- Possible human and environmental threats from transporting, storing and processing sulphur and sulphuric acid, in and between Walvis Bay and the mine site;
- Possible dust, noise and blast vibration threats to humans and the environment from the SK4 mining area, and dust and noise from the ore sorter plant, including waste rock management;
- Biodiversity implications, particularly in the SK4 mining area;
- Supply, storage, application, runoff and reuse of water, particularly in the SK4 mining area;
- Regional implications of bulk water supply;
- Visual impacts of the acid plant, ore sorter or SK4 mining activities; and
- Energy use.

The objectives of public participation are being maintained throughout this SEIA process. These are to provide information to the public, identify key issues and concerns at an early stage, respond to the issues and concerns raised, provide a review opportunity, and document the process properly.

3.2 IDENTIFICATION OF STAKEHOLDERS

The following stakeholder groups were identified during the Scoping Stage as the key ones to be consulted throughout the assessment process:

- Central government ~ Ministries of:
  - Mines and Energy
  - Health and Social Services
  - Labour and Social Welfare
  - Environment and Tourism
  - Agriculture, Water and Forestry
  - Regional and Local Government and Housing
  - Education
- Regional and local government:
  - Erongo Regional Council
  - Swakopmund Town Council
  - Walvis Bay Town Council
  - Arandis Town Council
- The !Oe#Gan Traditional Authority,
- other uranium mines in the Erongo Region,
- Rössing Uranium,
- The Rössing Foundation,
- the media,
- Namport,
- Namwater,
- Nampower,
- Transnamib,
- farmers, both small-scale and commercial,
- other economic sectors which may be affected by mineral exploitation, e.g. tourism,
- community groups and social institutions in Swakopmund, Walvis Bay and Arandis,
- service providers, and
- organised labour.

3.3 PUBLIC PARTICIPATION DURING THE SCOPING STAGE

The proposed project was advertised in national, regional and local newspapers, as reflected in Table 2. An example of one of these advertisements appeared as Annexure C of the Scoping Report of November 2007. The advertisements also announced the commencement of the SEIA process, provided information about the public participation meetings and invited registration as I&APs. The aim was to raise wide public awareness of the project.

Notices of the public participations meetings were posted in public places in Swakopmund, Walvis Bay and Arandis. Annexure D of the Scoping Report of November 2007 provided an example of one of these notices.

Chapter 3

A Public Information Document (PID) was forwarded to I&APs, made available at the public participation meetings and was provided on request. Annexure E of the Scoping Report of November 2007 provided a copy of the PID. This PID aimed to inform I&APs about the proposed development by RU and to promote participation by stakeholders in the SEIA process.

Newspaper	Placement Dates
Namib Times	14,17 August 2007
Republikein	15,17 August 2007
Republikein	20 August 2007
Namibian	15,20 August 2007
Namibian	17 August 2007
All.Zeitung	15,17 August 2007
All.Zeitung	20 August 2007
New Era	15,17 August 2007
New Era	20 August 2007
Economist	17 August 2007
Informante	16 August 2007
Southern Times	18 August 2007
Observer	18 August 2007
Plus Weekly	17 August 2007

Table 2: Schedule of newspaper advertisements, August 2007

A comment sheet was provided at the public participation meetings, inviting comments on issues that stakeholders saw as critical for inclusion in the SEIA.

Three public participation meetings were held during the initiation of the Scoping Stage of the SEIA process, as follows:

- Alte Brücke, Swakopmund : 20 August 2007 (<u>41 attendees</u>)
- Pelican Bay Hotel, Walvis Bay : 21 August 2007 (<u>17 attendees</u>)
- Arandis Town Hall, Arandis : 22 August 2007 (<u>91 attendees</u>)

The public participation meeting in Swakopmund was preceded by a presentation of the project to the media. All three meetings were conducted in an open-day format, which gave the public an opportunity to view posters of the project, and to raise questions with the specialists who were in attendance. Attendance registers for these meetings were compiled and all attendees whose names and contact details are legible have been included in the list of registered I&APs (Annexure I of the Scoping Report of November 2007). The original attendance lists are available on request.

As far as focus group and key informant meetings are concerned, a full list of these, together with minutes from the meetings, are provided in the Scoping Report of November 2007 in Annexure F and Annexure G respectively.

Regarding stakeholder feedback and ongoing involvement, a record of stakeholder comments, whether these were questions or concerns, was compiled in a form which records the comment, the name of the commentator, the form the comment took and the response thereto. This is a comprehensive list of comments made at all the meetings held during the public participation process, as well as comments submitted in writing. The stakeholder feedback forms are provided in the Scoping Report of November 2007 as two sheets in Annexure H.

All I&APs who have registered themselves during the Scoping Stage of the SEIA process are listed in Annexure I of the Scoping Report of November 2007.

Stakeholder awareness has been maintained through reports on progress wherever feasible, responses to written queries, and information dissemination where relevant. In all respects, there has been a productive two-way dialogue between the SEIA team and stakeholders.

For ease of reference, all correspondence to date is summarised in Table 4 below.

3.4 PUBLIC PARTICIPATION DURING THE SEIA STAGE

During the SEIA Stage of the process, public participation comprised the following:

- engagement with I&APs who have subsequently expressed an interest in the Scoping Stage participation process (refer to list below);
- presenting the findings of the Draft SEIA Report;
- registering any additional I&APs;
- noting and responding to questions and/ or issues of concern; and
- investigating issues at greater depth where the need for this has been indicated.

No formal comments or concerns were received by the practitioner responsible for public participation, Marie Hoadley, in response to the release in November 2007 of the Scoping Report. However, during November and December 2007, the RU website was visited 1 362 times by people viewing some or all of the documents that comprise the Scoping Report. With the release of the Draft SEIA Report on 22 January 2008, 407 visits to the RU website by 25 February 2008 were made by people viewing some or all of the documents that comprised the report.

The public participation practitioner initiated meetings with the people or institutions listed below on 13 and 14 November 2007, and RU personnel met with four concerned farmers on 6 December 2007. Minutes from these meetings are included in Annexure B of this report.

14 November 2007	Martha Swart	Manager, Jobs Unlimited, Swakopmund
13 November 2007	Joseph Jantze	Usakos Town Council CEO
13 November 2007	Petra Ondingo	Rössing Foundation
14 November 2007	Ebenhard Kandanga	Rössing Uranium
13 November 2007	Marcus Swartz	Corporate Services, Town Council of Swakopmund
6 December 2007	Hans Kriess Jochen Kriess Hartmut Fahrbach Erich Meyer	Concerned Farmers

During the SEIA Stage of the process, all registered I&APs were informed of the availability of the Draft SEIA Report, the period for review, the public meetings being held and the venues where the report would be available. Notices of the public participations meetings appeared in national, regional and local newspapers, as reflected in Table 3. The notices were also posted in public places in Swakopmund, Walvis Bay and Arandis. Annexure M provides examples of these notices and newspaper advertisements.

Newspaper	Placement Dates
Namib Times	18 & 22 January 2008
Republikein	16, 17 & 18 January 2008
Namibian	16, 17 & 18 January 2008

Table 3: Schedule of newspaper advertisements, January 2008

Three public participation meetings were held to present the findings of the Draft SEIA Report, as follows:

- Alte Brücke, Swakopmund : 22 January 2008 (45 attendees)
- Pelican Bay Hotel, Walvis Bay : 23 January 2008 (24 attendees)
- Arandis Town Hall, Arandis : 24 January 2008 (102 attendees)

At the same time, copies of the Draft SEIA Report were lodged for public viewing at the libraries in Swakopmund, Walvis Bay, Windhoek and Arandis. The report was also placed on RU's website and the public comment period for response to the Draft SEIA Report ended on 15 February 2008.

There are 229 registered I&APs and stakeholders on the project mailing list and they have been informed of the results of the public review of the Draft SEIA Report.

3.5 THE WAY FORWARD

With the comment period for the Draft SEIA Report having closed on 15 February 2008, the report has been updated to incorporate all the I&AP comments and concerns received. This finalised SEIA Report is now to be submitted to MET:DEA.

Should MET:DEA believe that the final submission contains information that is sufficiently comprehensive for sound decision-making, they will consider issuing a clearance for the project. Such clearance will probably include certain conditions, e.g. the undertaking of environmental controls as stipulated in the SEMP that accompanies this SEIA Report.

All registered I&APs and stakeholders will be informed of MET:DEA's decision once it is made available.

Project Activity	Dates	Notices	Letters	Documents	Meetings
Project Preparation – all phases	14 June 2007			Minutes of meeting	Multistakeholder Risk Identification Workshop, Swakopmund.
Project Initiation – all phases	August 2007				Meetings with authorities.
Initiation of Public Participation – all phases		Newspaper adverts. Notices in public places in Arandis, Swakopmund and Walvis Bay. RU's website.	Notification of project & invitation to stakeholders' meeting.	PID	Meeting with media.
	20-22 August			Stakeholder Issues Sheet (1)	Public Participation meetings in Swakopmund, Walvis Bay and Arandis.
	23 August – 22 September			Minutes of meetings. Stakeholder Issues Sheet (2)	Key informant and focus group meetings.
Notification of Phase 1 Scoping Report	13-14 November 2007	Notification of release of Phase 1 Scoping Report in print media and on RU's website.	Letters to I&APs notifying them of release of Phase 1 Scoping Report.	Phase 1 Scoping Report.	Key stakeholder meetings.
Focus group participation	13-14 November 2007			Minutes of meetings.	Meetings held with identified stakeholders.
	19-20 November 2007			Minutes of meetings. Stakeholder Issues Sheet. (3)	Focus group meetings.
	6 December 2007			Minutes of meeting.	Meeting with farmers.
Notification of Draft Phase 1 Social and Environmental Impact Assessment (SEIA) Report for comment	12 - 16 January 2008	Notification of release of Draft Phase 1 SEIA Rep in print media and on RU's website.	Letters to I&APs notifying them of release of Draft Phase 1 SEIA Rep.	Draft Phase 1 Social and Environmental Impact Assessment Report.	
Public Participation for Draft Phase 1 SEIA Rep and introduction of Phase 2 project components	22 – 24 January 2008	Newspaper adverts. Notices in public places in Arandis, Swakopmund and Walvis Bay, and RU's website.	Notification of public meetings.	Phase 1 Stakeholder Issues Sheets	Public Participation meetings in Swakopmund, Walvis Bay and Arandis.

Table 4: Summary of correspondence and documentation to date

4 ASSESSMENT METHODOLOGY

The purpose of this chapter is to describe the assessment methodology utilised in determining the significance of the construction and operational impacts of the proposed sulphuric acid production plant and associated sulphur storage and transport, the radiometric ore sorter plant and associated reject rock disposal, and the development of the SK4 ore body on the affected socio-economic and biophysical environment. It also addresses the challenge of subjectivity and the means of assessing cumulative impacts.

4.1 ASSESSMENT METHODOLOGY

A standardised and internationally recognised methodology[15] has been applied to assess the significance of the potential environmental impacts of RU's expansion project, outlined as follows:

For each impact, the EXTENT (spatial scale), MAGNITUDE (size or degree scale) and DURATION (time scale) are described. These criteria are used to ascertain the SIGNIFICANCE of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The decision as to which combination of alternatives and mitigation measures to apply for lies with RU as the proponent, and their acceptance and approval ultimately with MET:DEA. Chapter 6 of the SEIA Report explicitly describes RU's commitments in this regard. The tables on the following pages show the scale used to assess these variables, and defines each of the rating categories.

Assessment criteria for the evaluation of impacts

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	**National**	Within Namibia
	Regional	Within the Erongo Region
	Local	On site or within 1000 m of the impact site
Magnitude of impact (at the indicated spatial scale)	**High**	Social and/or natural functions and/ or processes are *severely* altered
	Medium	Social and/or natural functions and/ or processes are *notably* altered
	Low	Social and/or natural functions and/ or processes are *slightly* altered
	Very Low	Social and/or natural functions and/ or processes are *negligibly* altered
	Zero	Social and/or natural functions and/ or processes remain *unaltered*
Duration of impact	**Short term** (construction period)	Up to 7 years
	Medium Term	Up to 10 years after construction
	Long Term	More than 10 years after construction

[15] As described, *inter alia*, in the South African Department of Environmental Affairs and Tourism's Integrated Environmental Management Information Series (Gov of SA, 2002).

The SIGNIFICANCE of an impact is derived by taking into account the temporal and spatial scales and magnitude. Such significance is also informed by the context of the impact, i.e. the character and identity of the receptor of the impact. The means of arriving at the different significance ratings is explained in the following table, developed by Ninham Shand in 1995 as a means of minimising subjectivity in such evaluations, i.e. to allow for replicability in the determination of significance.

Definition of significance ratings

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	• High magnitude with a regional extent and long term duration • High magnitude with either a regional extent and medium term duration or a local extent and long term duration • Medium magnitude with a regional extent and long term duration
Medium	• High magnitude with a local extent and medium term duration • High magnitude with a regional extent and construction period or a site specific extent and long term duration • High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration • Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Low magnitude with a regional extent and long term duration
Low	• High magnitude with a site specific extent and construction period duration • Medium magnitude with a site specific extent and construction period duration • Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Very low magnitude with a regional extent and long term duration
Very low	• Low magnitude with a site specific extent and construction period duration • Very low magnitude with any combination of extent and duration except regional and long term
Neutral	• Zero magnitude with any combination of extent and duration

Once the significance of an impact has been determined, the PROBABILITY of this impact occurring as well as the CONFIDENCE in the assessment of the impact has been determined using the rating systems outlined in the following two tables. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring.

Definition of probability ratings

PROBABILITY RATINGS	CRITERIA
Definite	Estimated greater than 95% chance of the impact occurring.
Probable	Estimated 5 to 95% chance of the impact occurring.
Unlikely	Estimated less than 5% chance of the impact occurring.

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Definition of confidence ratings

CONFIDENCE RATINGS	CRITERIA
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Lastly, the REVERSIBILITY of the impact has been estimated using the rating system outlined in the following table.

Definition of reversibility ratings

REVERSIBILITY RATINGS	CRITERIA
Irreversible	The activity will lead to an impact that is permanent.
Reversible	The impact is reversible, within a period of 10 years.

4.2 SUBJECTIVITY IN ASSIGNING SIGNIFICANCE

Despite attempts at providing a completely objective and impartial assessment of the environmental implications of development activities, environmental assessment processes can never escape the subjectivity inherent in attempting to define significance. The determination of the significance of an impact depends on both the context (spatial scale and temporal duration) and intensity of that impact. Since the rationalisation of context and intensity will ultimately be prejudiced by the observer, there can be no wholly objective measure by which to judge the components of significance, let alone how they are integrated into a single comparable measure.

This notwithstanding, in order to facilitate informed decision-making, environmental assessments must endeavour to come to terms with the significance of the potential environmental impacts associated with particular development activities. Recognising this, Ninham Shand has attempted to address potential subjectivity in the current SEIA process as follows:

- Being explicit about the difficulty of being completely objective in the determination of significance, as outlined above;
- Developing an explicit methodology for assigning significance to impacts and outlining this methodology in detail. Having an explicit methodology not only forces the assessor to come to terms with the various facets contributing towards the determination of significance, thereby avoiding arbitrary assignment, but also provides the reader of the SEIA Report with a clear summary of how the assessor derived the assigned significance;

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- Wherever possible, differentiating between the likely significance of potential environmental impacts as experienced by the various affected parties; and
- Utilising a team approach and internal review of the assessment to facilitate a more rigorous and defendable system.

Although these measures may not totally eliminate subjectivity, they provide an explicit context within which to review the assessment of impacts.

4.3 CONSIDERATION OF CUMULATIVE IMPACTS

Namibia's Environmental Assessment Policy requires that, "as far as is practicable", cumulative environmental impacts should be taken into account in all environmental assessment processes. EIAs have traditionally, however, failed to come to terms with such impacts, largely as a result of the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires co-ordinated institutional arrangements; and
- Environmental assessments are typically carried out on specific developments, whereas cumulative impacts result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

However, when assessing the significance of the project level impacts in the next chapter, cumulative effects have been considered as far as it is possible in striving for best practice.

5 ASSESSMENT OF POTENTIAL IMPACTS AND POSSIBLE MITIGATION MEASURES

This chapter forms the focus of the SEIA process. It contains a detailed assessment of the operational (or long-term) impacts as well as the construction phase impacts on the affected socio-economic and biophysical environment, using the methodology described in Chapter 4. The summary of the assessment is contained in Chapter 6.

5.1 INTRODUCTION

Chapter 5 describes the potential impacts on the socio-economic and biophysical environments which may occur due to the proposed activities described in Chapter 2. These include potential impacts which may arise during the operation of the proposed sulphuric acid plant and associated sulphur storage and transport, the radiometric ore sorter plant and associated reject rock disposal, and the development of the SK4 ore body (i.e. long-term impacts), as well as the potential construction related impacts (i.e. short to medium term).

The full range of potential impacts identified during the Scoping Stage of this project is described in Section 2.3. From the full range of potential impacts, those that are clearly of minor significance have been screened out, after consideration of the specialist studies and other available information. The impacts identified as significant in Section 2.3 are assessed in this chapter.

It should be noted that biodiversity impacts are only of particular concern in the mining of the SK4 ore body, since this would intrude into a relatively less disturbed area. The sites of the acid plant and ore sorter are in already severely disturbed areas within the processing precinct of the mine and the biodiversity implications are not significant.

The presentation of the assessments of the identified impacts that follows begins with the socio-economic impacts that are common to all of the project components. Thereafter, the impacts related to each of the three components of the Phase1 expansion project are assessed. Several impacts that have social implications, e.g. air quality, visual impact, noise and vibration, radioactivity etc., are however included in the relevant sections that address the three project components.

Each of these impacts is assessed in detail and the significance of the impact determined in the following sections. The methodology used to assess the potential impacts is detailed in Chapter 4 of this report. The terms 'No mitigation' and 'Mitigation' reflected in the assessment tables in this chapter refer to the impact with no mitigation and with mitigation respectively, where these are available. Where alternatives are available for a particular impact, an evaluation is provided in a comparative table. The tables rate the relevant indicators, i.e. those factors that can be compared against each other in such a way that a preference is apparent, according to a scale of low, medium or high, and whether the impact would be positive or negative.

It should be noted that the range of alternatives included in the following assessment is limited to the disposal site for reject rock from the ore sorter, housing for construction and permanent employees, and schooling for employees' children. The assessment of alternatives is reflected in the relevant tables by means of additional rows. The majority of identified impacts, however, are assessed in terms of their acceptability insofar as best available technology or appropriate mitigation has been applied.

5.2 OPERATIONAL PHASE IMPACTS ON THE SOCIO-ECONOMIC ENVIRONMENT

Section 5.2 is largely derived from the specialist study undertaken by Marie Hoadley titled *Socio-economic Component of the Social and Environmental Assessment Report for the Rössing Uranium Mine Expansion Project: Socio-economic Impact Assessment and Recommendations for a Socio-economic Management Plan* and is structured accordingly. A copy of the report is included as Annexure C of this SEIA Report, together with copies of the related *Socio-economic Baseline Study* and *Statement of Alternatives*. The baseline study in particular provides vital scene-setting for this specialist study.

5.2.1 Impact on the economic sustainability of Arandis

a) Impact Statement

Arandis was established in 1976 to serve the needs of RU for accommodation for its employees. Until 1992, when the town was given to the Namibian government as an independence gift, the town was wholly supported by RU, and this support extended to health services, schooling, service provision, recreation and infrastructure maintenance. In 1994 Arandis was proclaimed a fully-fledged town and the local authority struggled to deliver services with an inadequate budget, a lack of capacity and non-payment by residents. The role Rössing had played in the support and functioning of Arandis in the past had built a strong dependence on the mine and the wave of retrenchments in the 1990's further impacted on the town. In effect, the town experienced two 'quasi-closures' and displays some of the characteristics of communities impacted by closure, such as the erosion of the local authority's revenue base, increased demands on local government as the number of indigents increases, the breakdown of social networks and community cohesion and the failure of alternative economic activities to develop. Because of the proximity to the mine, dependency on RU has remained one of the town's most marked characteristics, and the Town Council of Arandis has continued to rely on assistance, both financial and administrative, from RU and the Rössing Foundation in times of crisis. After the mine has closed, this support would no longer exist.

The proposed expansion project has raised expectations that RU's activities will restore the prosperity of the town. There is a very real possibility that economic diversification away from the mine will not receive the priority and focus that it needs for the town to develop independently and sustainability. In view of its historical role in the establishment and development of Arandis, RU has a corporate social responsibility not to intensify the relationship of dependency that exists between the company and the town. At the same time, Arandis remains one of RU's communities of interest, and the company is desirous of promoting the sustainability of the town. This can only be achieved by the encouragement of a diversified economic base which enables the town to survive and develop independently after closure, and by ongoing assistance with building capacity in the Town Council of Arandis.

Note should also be taken of the fact that investment is occurring in Arandis from mining activities in the area other than RU's. There are clearly cumulative impacts that could result, over which RU may not have direct influence.

b) Discussion

This impact has been identified and ranked only from the aspect of RU's involvement in the economy of the town. However, the mitigation measures proposed should be seen against the background of other mining-related investments coming into the town, the steady increase in population since 2005 and commitments by RU and other mining companies to promote and support the diversification of the economy.

The assessment of this impact is based on the premise that continued investment in infrastructure in Arandis by RU will perpetuate the town's economic dependence, resulting in its possible economic collapse when mining activities cease. Although the impact would be felt at the local and regional levels in particular, there are national implications in that labour-sending areas elsewhere in Namibia would lose a source of income and the government's Social Fund will incur higher demands and receive less contributions. The magnitude is regarded as high, since social functions would be severely altered. The duration of the impact would be long term and the probability of it occurring is regarded as certain. However, the impact could be reversed over time.

Given that economic structures to support sustainable development in Arandis are not well established, the local economy would be vulnerable to the consequences of the eventual termination of economic inputs from RU and its employees. The negative social consequences suffered by post-closure mining communities have been well documented elsewhere. Consequently, without mitigation, the significance of the impact is regarded as highly negative.

Mitigation measures

However, the potential to bring about mitigation measures is high, if RU actively works towards reducing Arandis' dependency over time. Bearing in mind that the present SEIA is part of the planning for mining activities at Rössing to be extended to 2026, there would be a considerable period of time for RU to further pursue means of economic diversification and thus contribute to the town's sustainability. By adopting such measures, this impact could become a moderately positive one.

Impact on Arandis' economic sustainability		
	No mitigation	**Mitigation**
Extent	National	National
Magnitude	High	Medium
Duration	Long term	Long term
SIGNIFICANCE	**High (-)**	**Medium (+)**
Probability	Definite	Probable
Confidence	Certain	Sure
Reversibility	Reversible	Reversible

5.2.2 Impact on permanent employment creation

a) Impact Statement

Figure 16 shows the projected number of permanent RU employees on a yearly basis until the proposed 2026 mine closure. An overall increase over present employment levels of approximately 700 is indicated.

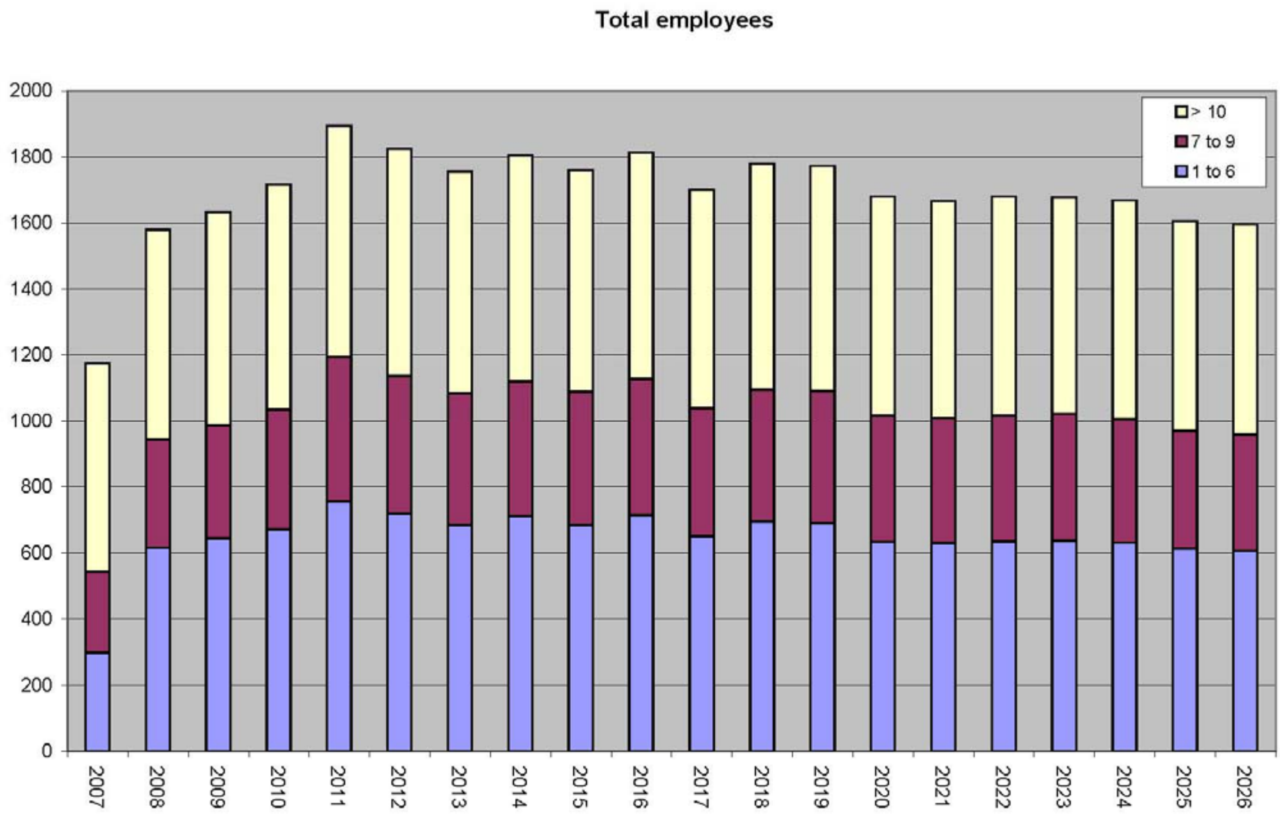

Figure 16: 2007 projection of employment figures at RU to 2026 (source: RU)
[Differentiated scale = employment ranks: where >10 = supervisors, superintendents & managers; 7-9 = team leaders, technicians & artisans; and 1-6 = operators & assistants]

On average, and including the current workforce contingent, the workforce skills profile will be:

Grades 1-6 = 36% of the workforce. The group includes operators and assistants. The greatest demand in this group is for Grade 6 level skills.

Grades 7-9 = 22% of the workforce. This group includes team leaders, technicians and artisans. The greatest demand in this group is for Grade 8 level skills.

Grades 10 and above = 39% of the workforce. The group includes supervisors, superintendents and managers. The greatest demand in this group is for Grade 10 level skills.

It should be noted that mining operations generally require skilled employees, who are not readily found among the unemployed in the region.

An important benefit of an increase in employment opportunities is the multiplier effect felt throughout the economy, i.e. where new jobs create further economic opportunities in providing goods and services to the broadened employment base. This can magnify and stimulate commercial activity in other economic sectors.

b) Discussion

The impact would be felt at all levels, i.e. local, regional and national, since the multiplier effect would be felt in all the neighbouring towns, the regional rates base would improve and remittances to labour-sending areas elsewhere in Namibia would also occur. The magnitude of the impact is regarded as medium since there would be a notable alteration in employment levels and economic activity. The duration of the impact is regarded as long term, given the 2026 time horizon for the life of the mine. The probability of it occurring is definite and the impact is entirely reversible if economic conditions should change.

The significance of permanent employment opportunities is therefore regarded as moderately positive. Notwithstanding the long term nature of the impact, intervention (mitigation) would be necessary to maximise the benefits beyond mine closure.

Mitigation measures

To further enhance the positive benefits of this impact, it is suggested that on-going training programmes and skills enhancement are put in place that can have an effect beyond the proposed mine closure in 2026[16]. People thus trained will be better equipped for employment elsewhere or for self-employment. Maximising the training opportunities suggested for the construction phase (see Section 5.6.1 below) may also allow less skilled local people to access permanent employment, to the benefit of the operational phase of the project. If these mitigation measures are applied, this impact will become a highly positive one.

[16] It is recognised that RU has extensive training and support programmes already in place, which could form the basis for the enhanced training being suggested.

Impact on permanent employment creation		
	No mitigation	**Mitigation**
Extent	Local - National	Local - National
Magnitude	Medium	Medium - High
Duration	Long term	Long term
SIGNIFICANCE	**Medium (+)**	**High (+)**
Probability	Definite	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible

5.2.3 Impact on public health and safety

a) Impact Statement

This assessment considers the overarching social impact on public health and safety of the proposed Phase 1 development when seen against RU's existing management system for such impacts.

Public health and safety impacts that could occur would primarily apply to visitors to the site. However, the system of managing these impacts includes a safety induction programme, the provision of personal protective equipment and the guidance by properly trained RU personnel when on site.

Off-site public health and safety impacts could potentially be derived from downstream groundwater contamination and windborne dust and air pollution, as well as the transport of goods, materials and product to and from the mine. Note that a quantitative assessment of the risk to human life from the acid plant and associated handling, storage and transport of sulphur has been undertaken as a separate specialist study and is reported in Section 5.3.2 below. Possible impacts resulting from dust from the operation of the ore sorter are specifically reported in Sections 5.4.1 and 5.4.2, and from the SK4 mining activity in Sections 5.5.1 and 5.5.2. Impacts of groundwater contamination from specific project components are reported in Sections 5.3.4, 5.4.4 and 5.5.4.

b) Discussion

The extent of the impact is regarded as regional, since certain pollutants can move beyond the site of the impact. The magnitude would be high if not properly managed. However, with RU's commitment to meeting the statutory requirements for public health and safety, this may be regarded as low. Also, the duration of public health and safety impacts would be for the life of the mine and in some instances, e.g. post-closure management of the site, for longer. Its significance is therefore regarded as medium negative and its management would be an extension of the existing system.

Mitigation measures

Note that mitigation is not reflected in the assessment table, since applying a system of managing public health and safety is a statutory requirement .

Impact on public health and safety		
	No mitigation	**Mitigation**
Extent	Regional	N/A
Magnitude	Low	N/A
Duration	Long term	N/A
SIGNIFICANCE	**Medium (-)**	N/A
Probability	Probable	N/A
Confidence	Certain	N/A
Reversibility	N/A	N/A

5.2.4 Impact on housing and accommodation

a) Impact Statement

In the order of 400 additional accommodation units will be required by RU to house the projected increased workforce that would result from their expansion project. Other mining interests in the Erongo Region will also need housing for employees. The shortage of housing stock and erven for development in Arandis, Swakopmund and Walvis Bay is therefore of concern for RU's intended mining developments. The release of proclaimed erven, ready for development, is not anticipated in the short term in most areas. The situation is aggravated by the involvement of private developers who drive prices up, especially in an environment of high demand.

Market forces can be expected to influence the housing shortage but while demand exceeds supply, prices will be driven up. It is possible that the property market will be destabilised, that locals will not be able to afford to buy property, especially in Swakopmund and Walvis Bay, and that the cheaper option of Arandis will become attractive to many lower income home owners or tenants. The result is likely to be the entrenchment of the perception of Arandis as a town for the lower socio-economic sector of the work force, an increase in property prices in that town and a concomitant increased dependency of the local authority on mining-related revenue.

Two alternatives were examined in the socio-economic specialist study, namely the option of RU providing additional housing for the majority of workers in Arandis, and the option of housing the majority of workers in Swakopmund and/or Walvis Bay. Based on the recommendations made in the *Statement of Alternatives* provided as part of the socio-economic study, a simple tabulation is presented below. The table rates the indicators, i.e. those factors that can be compared against each other in such a way that a preference is apparent, applied to the two alternatives on a nominal scale of low, medium or high, and whether the impact would be positive or negative. Table 5 shows that, while the Arandis option has numerous highly positive benefits, the constraints are also highly negative. The Swakop/Walvis option does not show the same extremes of positive or negative impact.

Indicators ↓ Alternatives →	Arandis		Swakop/Walvis	
Proximity to the mine	High (+)		Medium (-)	
Increased housing stock	High (+)		Medium (+)	
Increased local authority income	High (+)		Medium (+)	
Increased local economy income	High (+)		Medium (+)	
Schools' capacity	Medium (+)		Low (-)	
Public perception of RU's social commitment	High (+)		Medium (+)	
Dependency on RU-related income	High (-)		Medium (-)	
Property prices	High (+)		Medium (+)	
Mine closure	High (-)		Medium (-)	
New non-local residents	High (-)		Medium (-)	
Breadth of choice	Medium (-)		Low (+)	
Resilience of local economies	High (-)		Medium (-)	
Entrenchment of social differentiation	High (-)		Low (-)	

Table 5: Rating of the two housing alternatives (low to high impacts and positive or negative)

b) Discussion

It is argued that the economic dependency of Arandis on RU is likely to increase with an increased resident RU workforce and an increased dependency on local government revenue based on employment at RU. This will be a constraint on the sustainability of the town. Prices of property in Arandis are already rising, largely due to speculative buying. A diversified economic environment, which includes a need for housing by non-mineral sectors and which would enable the property markets in Swakopmund and Walvis Bay to stabilise, is absent in Arandis. The recommendation is thus that housing for additional RU employees should occur in Swakopmund and/or Walvis Bay, although housing may be provided for employees preferring to reside in Arandis.

This discussion and the assessment table below are based on the premise that there may well be constraints on the creation of additional housing, notwithstanding that positive economic benefits will certainly result in the shorter term. It is the degree to which these economic benefits are sustainable that has been the main criterion here.

Both the Arandis and Swakop/Walvis alternatives would have regional consequences. The magnitude of the impact would be higher in the case of Arandis because of the less diversified economy and more limited housing stock. A medium term duration of the impact can be expected in both cases, since its effects will be felt for several years. In terms of sustainability, therefore, a medium negative impact significance is believed to be relevant to bringing about additional housing in Arandis, whereas an impact of low negative significance would apply to the Swakop/Walvis alternative.

It is argued that the economic dependency of Arandis on RU is likely to increase with an increased resident RU workforce and will be a constraint on the sustainability of the town. The stability of the property market in Arandis would also eventually be under threat, and the diversified economic environment which would enable the property markets in Swakopmund and Walvis Bay to stabilise are absent in Arandis. The recommendation is thus that housing for additional RU employees should occur in Swakopmund and/or Walvis Bay, although housing may be provided for employees preferring to reside in Arandis.

Mitigation measures

Indications are that RU should initiate and facilitate housing developments by a third party so as not to destabilise the property market through its own requirements. This is not offered as mitigation since exactly how and where such development would occur has yet to be decided.

Impact of housing and accommodation				
	Arandis		**Swakop/Walvis**	
	No mitigation	**Mitigation**	**No mitigation**	**Mitigation**
Extent	Regional	N/A	Regional	N/A
Magnitude	Medium	N/A	Low	N/A
Duration	Medium term	N/A	Medium term	N/A
SIGNIFICANCE	**Medium (-)**	N/A	**Low (-)**	N/A
Probability	Probable	N/A	Probable	N/A
Confidence	Sure	N/A	Sure	N/A
Reversibility	Reversible	N/A	Reversible	N/A

5.2.5 Impact on local economies

a) Impact Statement

Large scale mining operations are typically economic drivers of considerable importance and their influence is felt well beyond the mine site. It is estimated that for every job created in the mining sector, three additional jobs are created in other sectors. Mines also require goods and services during their operation and employees with expendable cash further the need for secondary and tertiary economic sector development. By 2011, when the labour complement peaks, extra employment at RU will contribute an estimated additional N$50 million to the economy. Socio-economic conditions should generally improve, particularly as a result of increased benefits received by local authorities.

b) Discussion

The impact is regarded as regional, since its effects will be felt in the main towns in the Erongo Region. The magnitude is believed to be medium, since a notable improvement in local economies is likely. The effects will be felt throughout the life of the mine and the impact is thus regarded as long term. Although the impact significance on local economies of RU's proposed expansion project should be considered as positively high, it is believed that it should be reflected as medium. The reason for this is that Swakopmund and Walvis Bay have economies that are sound and diversified, whereas Arandis and Usakos lack such diversity and sustainability. This differentiation would make it difficult to optimise the economies since different interventions would be required for the different towns. The impact is thus considered to be of a positively medium significance.

Mitigation measures

The constraints on optimisation caused by the differentiated economies between the main towns affected by RU's proposed expansion project mean that common mitigation measures are not possible.

Impact on local economies		
	No mitigation	**Mitigation**
Extent	Regional	N/A
Magnitude	Medium	N/A
Duration	Long term	N/A
SIGNIFICANCE	**Medium (+)**	N/A
Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Reversible	N/A

5.2.6 Impact of inward migration

a) Impact Statement

Namibia's rate of unemployment is high and there is a spatial disparity between the concentrations of the populace and where employment is available, e.g. most employment opportunities are in the coastal and central regions of the country, whereas the northern region has the highest number of people. The movement of people seeking work within the country is thus substantial.

Impacts that may be expected are an increase in local unemployment rates, densification of already inadequate housing and informal settlements, and related increases in poverty, ill-health and social ills.

b) Discussion

Since the resources of both the local authorities as well as the regional authority would be challenged as a result of in-migration, the impact is regarded as regional. The magnitude of the impact is regarded as medium as a result of the notable alteration in social functioning and the duration would be long term, since the perception of work availability will persist for the life of the mine. Consequently, this impact is believed to be of a negatively high significance.

Mitigation measures

As far as mitigation is concerned, it is unlikely that any such actions would substantially reduce the impact of in-migration. Although Arandis, Swakopmund and Walvis Bay local authorities are attempting to address the living conditions of new arrivals, they have particular resource and capacity constraints. Little in the way of substantial mitigation of this impact is thus foreseen, although RU would continue to strive for their workforce to live in socially stable conditions.

Impact of inward migration		
	No mitigation	**Mitigation**
Extent	Regional	N/A
Magnitude	Medium	N/A
Duration	Long term	N/A
SIGNIFICANCE	**High (-)**	N/A
Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Irreversible	N/A

5.2.7 Impact on the availability of schooling

a) Impact Statement

The provision of social services in the form of health care and schooling in the Erongo Region is generally high, although some disparities exist with regard to health services. The capacity of schools in Swakopmund and Walvis Bay is under pressure as a result of the perception that schools in the towns offer a better education than those in rural areas and the demand to accommodate learners from other areas is high. Arandis does, however, have some capacity to accommodate additional pupils in its schools.

This section specifically addresses the impact of the availability of schooling for the children of an expanded RU employee complement. The *Statement of Alternatives* provided as part of the socio-economic study presented four possible scenarios and an evaluation of their positive and negative indicators, as follows:

ALTERNATIVE 1 : BUILDING EXTRA CLASSROOMS AT EXISTING SCHOOLS

Positive indicators
Economically feasible
Capacity can be built in schools and grades where it is currently most lacking
Negative indicators
Children of RU's workforce will not be guaranteed placement
The Ministry of Education may wish to control at which schools classrooms should be built
Provision of education is a function of government and it is not desirable or sustainable for mining companies to take over the role of government.

ALTERNATIVE 2 : BUILDING A NEW SCHOOL IN COLLABORATION WITH OTHER MINING COMPANIES

Positive indicators
Collaboration makes the alternative economically feasible
The Ministry of Education (Erongo Region) has indicated that it has the capacity to take over and maintain such a school post-closure
The Ministry of Education indicated, during the public participation process, that this was an option favored by it.
Public image enhancement for the uranium sector.

Negative indicators
Two schools will be required (or a comprehensive one) for both primary and secondary schooling
Provision of education is a function of government and it is not desirable or sustainable for mining companies to take over the role of government.

ALTERNATIVE 3 : BUILDING A HOSTEL IN ARANDIS

Positive indicators
Arandis has capacity in its schools but no hostel facilities.
Priority can be given to children of the RU workforce.
It is not necessary to house the workforce in Arandis to ensure schooling for their children.
As part of the vision for Arandis is to develop it into a Centre of Excellence in Education, such a hostel could become part of the infrastructure of such a Centre on closure.
The hostel could also accommodate some of the learners in Arandis who are currently living in the town without any supervision.
Negative indicators
Ongoing funding will be required until closure.
The schools do not have sufficient capacity to accept all the children of the RU workforce.
The standard of schooling in Arandis is not highly regarded and parents prefer to send their children to Swakopmund or Walvis Bay.

ALTERNATIVE 4 : LOBBYING GOVERNMENT TO BUILD NEW SCHOOLS

Positive indicators
Government takes up its responsibility, but there is room for partnership collaboration with the minerals sector.
Based on the nature of the collaboration, the Chamber of Mines can negotiate for dedicated space for the children of mining workforces.
Cost efficient
Children can attend school from their homes.
The minerals sector, because of its contribution to the Namibian economy and RU, in particular, because of its history of funding education and training, either through its own Corporate Social Investment initiatives or through the Rössing Foundation, is in a strong lobbying position.
Negative indicators
One school is unlikely to be sufficient for the extra demands of the minerals sector as well as the annual growth of learners coming to schools in the coastal town.
Historically, education in Erongo has been poorly funded by central government. It is likely that the Ministry of Education is waiting for the mining sector to take the initiative in this regard.

b) Discussion

The following discussion is an extract from the *Statement of Alternatives* provided as part of the socio-economic study:

"The alternatives have not been considered in terms of which schools have the most capacity. The coastal towns do not have any, and that is where the larger part of the workforce is likely to reside. Arandis has some capacity, but most of the workforce will not be residing there.

Alternative 1 is not a feasible one in view of the fact that RU will not be able to secure dedicated places in the classrooms.

Alternative 2 has constraints in the sheer size of the schooling requirements. This is a cumulative impact, but possibly it is not one that can be dealt with by collaboration between the mining companies.

Alternatives 1 and 2 share the undesirable indicator of the minerals sector abrogating the role of government.

Alternative 3 has a number of positive indicators, but it will be only a partial solution, and only for the children of the RU workforce, as the schools do not have extraordinary capacity. The reluctance of parents to send their children to schools in Arandis is a constraint which is currently receiving attention from the Rössing Foundation, and the quality of schooling should have improved by the time RU's requirements increase.

This alternative should be born in mind as a potential initiative in conjunction with Alternative 4.

Alternative 4 is the optimal one in terms of sustainability and roles and responsibilities. It has the possibility of dedicated places, but no estimation can be made of how many such spaces would be made available. The sheer size of the requirements and government reluctance to fund schooling in Erongo will make it difficult of implementation, but it is the preferred alternative."

Without purposeful action on the part of any of the parties involved, whether RU, government or other mining companies, the impact on schooling will be of a regional extent and a medium magnitude, since a notable effect would be felt throughout the larger towns in the Erongo Region. The duration would be medium term, assuming that appropriate resources are allocated to addressing the schooling shortcomings in the next few years. The impact on schooling is thus believed to be of medium negative significance.

Mitigation measures

Available mitigation in this case amounts to undertaking purposeful and collaborative actions to address the need for schooling. The option of government building new schools has emerged from this study to be the preferred one. However, provided that purposeful actions are undertaken, a composite assessment of the four alternatives would reduce the significance of the impact to a low negative one.

Impact on schooling		
	No mitigation	**Mitigation**
Extent	Regional	Regional
Magnitude	Medium	Low
Duration	Medium term	Medium term
SIGNIFICANCE	**Medium (-)**	**Low (-)**
Probability	Definite	Definite
Confidence	Certain	Sure
Reversibility	Reversible	Reversible

5.2.8 Impact on infrastructure

a) Impact Statement

The impacts addressed here are the generic ones of water supply and reticulation, and the provision of electricity and transportation facilities. Note that these infrastructure services have impacts that are all cumulative in nature. The impacts are dealt with here insofar as they are of relevance to RU's proposed expansion project, but it must be noted that impacts on infrastructure services are all cumulative in nature.

WATER SUPPLY

The bulk supply of water to RU will have to be increased if the expansion project is to be pursued and NamWater is in the process of improving the volume of water provided to the region by means of desalination. The expected increase in freshwater consumption for RU's Phase 1 expansion projects combined is approximately 2 000 m^3/day, thus raising the mine's demand annually from 3.3 Mm^3 to 4.0 Mm^3. This increase is nevertheless within the maximum allowance of 4.5 Mm^3/year as contracted with NamWater. A public commitment to the installation of a desalination plant to increase regional bulk supply on the part of NamWater appeared in Namibian newspapers on 23 November 2007. Envisaged to be completed by 2009, NamWater's desalination plant will be on-line before RU's expansion project becomes operational. Given that the availability of an increased regional supply of water in bulk from NamWater is a critical assumption for RU's expansion project, it is not addressed further in this section. However, the management of water resources on the mine site is addressed in detail at the project component level in Sections 5.3.4, 5.4.4 and 5.5.4.

ELECTRICITY SUPPLY

As far as electricity is concerned, RU presently acquires the approximate 30 MW they use from NamPower. However, a consequence of their proposed acid plant is that excess heat will be used for the generation of additional electricity on the Rössing mine site. This will result in RU's requirements for additional electricity for their proposed developments being significantly offset, since about 10 MW will be generated in this way. Nevertheless, about 17 % more electricity than their present usage would be needed.

The situation regarding electricity needs on the mine should be seen against the background of Namibia's supply being under pressure, due in part to reliance on outside sources. Of the 400 MW presently used in Namibia, 155 MW are received from outside the country. NamPower is actively pursuing additional generating infrastructure to address the situation but none of their projects will become operational in the short term. RU's energy requirements could thus impact on the availability of electricity to other consumers.

b) Discussion

The extent of the impact is regarded as national, given the implications of shortages throughout the national grid. The magnitude is believed to be low, since RU's Phase 1 project components will not require additional draw off from the grid, given the electricity that will be generated by excess heat from the acid plant. The duration of the impact would be short term if the immediacy of the situation is borne in mind. The significance of this impact is therefore regarded as negatively low.

Mitigation measures

Mitigation measures that may be considered would include the typical energy saving strategies applied generally, in keeping with RU's current management actions. Alternative sources of electricity may also be considered but it is not believed that such measures would significantly change the present situation in the short term.

Impact on electricity supply		
	No mitigation	**Mitigation**
Extent	National	National
Magnitude	Low	Low
Duration	Short term	Short term
SIGNIFICANCE	**Low (-)**	**Low (-)**
Probability	Definite	Definite
Confidence	Unsure	Unsure
Reversibility	Reversible	Reversible

TRANSPORTATION

Road safety from increased traffic is of prime concern (Stubenrauch Planning Consultants, 2007) and is an issue that should be monitored if future intervention is necessary. Particular issues are weather conditions causing poor visibility and the implication for mass transport.

The impacts on transportation systems would be a result of increased volumes of traffic needing to be accommodated on the existing road network. Such increases would be over and above the growth of 6 % per annum on the B2 National Road between Swakopmund and Usakos determined by the Namibian Roads Authority. However, a traffic impact assessment undertaken for the Trekkopje Uranium Project has estimated that the road has sufficient capacity to accommodate the projected increase in traffic numbers until well after 2020 (Turgis Consulting, 2007).

Figures from 2006 (Stubenrauch Planning Consultants, 2007) show that 884 RU employees commuted by bus to and from the mine. This is 94 % of the total staff complement of RU. With the number of employees projected to increase by 700 by 2011, the implications for accidents on roads already known to be hazardous due to poor visibility, must be seriously considered. Such commuting occurs at peak times when other traffic volumes are also at their highest. The section of the B2 National Road between Arandis and Swakopmund is of particular concern and it should be noted that mass transport, i.e. in busses, has the consequence of multiple injuries if an accident should occur. Note that Phase 2 of the SEIA for RU's expansion project will re-examine the issue of transportation impacts and traffic safety in more appropriate detail.

c) Discussion

The extent of this impact is believed to be regional, since it would affect all the users of the B2 National Road. Its magnitude is regarded as medium because the safety of of RU employees may be compromised. The duration of the impact is long term, since it will be felt for the duration of the mine. The significance of impacts resulting from transportation is thus regarded as a medium negative.

Mitigation measures

RU presently has driver safety and training programmes and road user risk reduction systems in place. It also intervenes where traffic and road use hazards are identified. However, RU is not able to exert direct control over other road users and the potential for additional mitigation is thus limited

Impact resulting from transportation		
	No mitigation	**Mitigation**
Extent	Regional	Regional
Magnitude	Medium	Medium
Duration	Long term	Long term
SIGNIFICANCE	**Medium (-)**	**Medium (-)**
Probability	Probable	Probable
Confidence	Sure	Sure
Reversibility	Reversible	Reversible

5.3 OPERATIONAL PHASE IMPACTS OF THE ACID PLANT AND ASSOCIATED STORAGE AND TRANSPORT

5.3.1 Impact on air quality

A full copy of the specialist study report titled *Air Quality Impact Assessment for the Proposed Expansion Project for Rössing Uranium Mine in Namibia: Phase 1* compiled by Airshed Planning Professionals is contained in Annexure D1 of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

The installation of the proposed acid plant would result in elevated emissions of SO_2 and SO_3/H_2SO_4[17] from the stack, with the potential of impacting on workers on the site and on residential areas further afield. Besides examining the routine operation of the plant, upset conditions related to the starting up and potential malfunctioning of the plant were also considered. Dispersion modelling was undertaken for these different operating and upset situations, after the baseline conditions and an emissions inventory had been prepared. The dispersion modelling has thus allowed for the prediction of air quality impacts on human health.

In determining relevant legal requirements, the air quality specialist determined that Namibia has adopted the current and proposed South African air pollution legislation. The specialist study, however, used a variety of national and international air quality standards, to ensure a comprehensive and defendable understanding of such requirements. The limits against which

[17] This parameter included acid mist, H_2SO_4.

the predicted SO_2 and SO_3 emissions were compared were thus the current and proposed South African standards, the World Health Organisation (WHO) guidelines, the European Community (EC) and Occupational Safety and Health Administration limits and the screening levels for H_2SO_4 derived from the Californian Office for Environmental Health Hazard Assessment in the USA.

b) Discussion

The findings of the study show that the highest predicted daily SO_2 ground level concentration under normal operating conditions is 47 µg/m^3 for the proposed 50 m high stack[18]. Compared to the adopted standard of 5 720 µg/m^3 set as a daily limit by the Occupational Safety and Health Administration, the predicted ground level concentrations of SO_2 resulting from the proposed acid plant for all situations are significantly below levels of concern for human health. Regarding upset conditions, predicted ground level concentrations are all below the adopted standards for the averaged periods of measurement.

As far as SO_3/H_2SO_4 is concerned, the adopted standard is 120 µg/m^3/hour for public exposure and 1 000 µg/m^3/day for worker exposure, per the Californian Office for Environmental Health Hazard Assessment. The findings of the study show that the highest predicted daily SO_3/H_2SO_4 ground level concentration under normal operating conditions is 1.6 µg/m^3 for the proposed 50 m high stack. The predicted concentrations of these pollutants resulting from the proposed acid plant for all situations and for both public and worker exposure are thus significantly below levels of concern for human health.

This impact is regarded as local in extent, since effects will not be felt beyond the mine boundary, as confirmed by the air quality study. The magnitude is believed to be low at most, with a slight alteration to natural or social functions and processes expected. The duration would, however, be long term, given that the intention is for the plant to operate for the life of the mine. The significance of this impact is therefore regarded as negatively low.

Mitigation measures
Over and above normal operating conditions, mitigation measures in the form of specified controls over start up and upset conditions as well as strict adherence to prescribed emission limits can further reduce the magnitude of this impact. Stack monitoring is also recommended, to verify that the operation of the plant remains within acceptable limits.

Impact of acid plant on air quality		
	No mitigation	**Mitigation**
Extent	Local	Local
Magnitude	Low	Very low
Duration	Long term	Long term
SIGNIFICANCE	**Low (-)**	**Very low (-)**

[18] Note that both 50 m and 75 m stack heights were assessed in the air quality study. Since a 50 m stack height has proved to be acceptable in terms of ground level SO_2 and SO_3/H_2SO_4 concentrations not affecting workers on site or the public, the 50 m stack has been accepted as the height being assessed in the present SEIA.

Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Reversible	Reversible

5.3.2 Impact on human health

The specialist study report titled *Risk Assessment of the Sulphuric Acid Plant as part of the Proposed Expansion of Rössing Uranium Mine, Namibia* (revision 2) compiled by RisCom is included as Annexure E of this report. It forms the basis of the findings presented in this section. The issues of bacteriological contamination associated with cooling towers and the long term occupational health and safety implications for operators of the acid plant are also addressed in this section, derived from information provided by the CSIR (see Annexure F).

a) Impact Statement

RISK ASSESSMENT

As described in Section 2.1.1, elemental sulphur would be imported via the Port of Walvis Bay and railed to the mine site where it would be stored for burning in the acid plant. Impacts related to the transport and storage of sulphur are explosions of sulphur dust and sulphur fires.

A sulphur dust explosion could result from the ignition of a volume of dust particles at a concentration within the flammable range of the substance and of a particular size. It is intended that sulphur would be handled in prilled, i.e. pelleted, form and dust would thus only be a consequence of its abrasion. Sulphur would be stored in the open on the mine, further reducing the possibility of the collection of dust concentrations[19].

Sulphur is flammable and combusts readily when exposed to heat, sparks, flame or chemical reaction with oxidisers. The oxides of sulphur fumes given off by combusting sulphur are highly toxic. Sulphur fire events during railage, storage and processing were examined in the specialist risk assessment study. Besides the risk from toxic sulphur dioxide (SO_2) fumes, burning sulphur would also pose a thermal radiation risk to humans and to structures. Pool fires, i.e. in tanks or bunded areas and usually as a result of leakage or spillage, were also examined.

Accidental releases of the three extremely hazardous compounds in use during the acid burning process, namely sulphuric acid, SO_2 and sulphur trioxide, were evaluated in terms of their risks if equipment failure were to occur.

BACTERIA IN COOLING SYSTEM WATER

It is know that the bacterium *Legionella pneumophila* occurs in cooling systems used in the chemical industry. Such bacteria cause Legionnaire's disease, which is distributed via aerosols and may be fatal amongst immuno-compromised individuals. The Rössing mine's arid setting

[19] Note that the handling and storage of elemental sulphur in the Port of Walvis Bay may be subjected to another assessment process, as described in Sections 1.5 and 2.1.1.

and consequent high rates of evaporation will reduce the chances of proliferation of the organism, and applying best available technology in the design of the acid plant cooling system should limit surfaces suitable for its occurrence.

LONG TERM OCCUPATIONAL HEALTH AND SAFETY

As far as the long term occupational health and safety implications for operators of the acid plant are concerned, it must be recognised that exposure to sulphur dioxide would be the primary risk. Also, the air quality study reported in Section 5.3.1 above shows that on site levels of SO_2 during all operational situations of the acid plant would be well below prescribed limits Nevertheless, long term exposure to SO_2 is known to result in chronic conditions affecting the sense of smell, susceptibility to respiratory infection and other bronchial conditions, and pulmonary impairment. Since an established system of handling and storage of sulphuric acid is in place on the mine, this aspect is not considered here.

It should be noted that RU undertakes multi-level risk and hazard assessments per Rio Tinto's requirements for the management of health, safety and the environment for all new projects. Such a Hazard and Operability (HAZOP) risk identification process is being carried out for the acid plant and the outcomes are being integrated into the Environmental Management System component of RU's Occupational Health, Safety and Environment management system. This is besides the quantitative risk assessment undertaken for the present SEIA reported below and is addressed in more detail in the draft SEMP presented in Annexure A.

b) Discussion

RISK ASSESSMENT

After identifying the various risk scenarios that could possibly result from the handling of sulphur and its processing to produce sulphuric acid, these were analysed and predictions of the maximum risk to individuals were determined. In summary of the findings of this specialist study:

- The risks from thermal radiation from pool fires as well as railcar or sulphur store fires are "acceptable", i.e. a trivial risk of 3 in 10 million per year[20]. Localised injury may result but the public would not be at risk.
- Given that sulphur would be stored in the open on the mine, the risk of dust explosion would not be significant.
- Toxic vapour clouds that may result from a sulphur fire would present a 1 % chance of fatality within 203 m of the fire. However, the public would not be exposed to the risk, as it would be within restricted areas, and it is defined as "acceptable", i.e. a trivial risk of 3 in 10 million per year[20]. In a worst-case situation of a full rupture of piping in the acid plant, the 1 % chance of fatality would extend to 1 km but this is also defined as an "acceptable" risk.

[20] Based on the *As Low As Reasonably Practicable* risk tolerability evaluation system used in the United Kingdom, ranging from acceptable (3 in 10 million chance per year) to intolerable (1 in 10 000 chance per year). Playing football, for instance, falls into the acceptable risk category with a 4 in 10 million chance of fatality per year.

This impact is regarded as regional, since it includes the route of the railage of sulphur from Walvis Bay harbour. Its magnitude would be very low, since it would have a negligible affect. Its duration, however, would be long term, i.e. for the life of the mine/acid plant. The significance of the impact on public health is thus believed to be negatively low.

Mitigation measures

Additional mitigation measures are not considered, since best practice in the form of the most stringent international emission standards is already being applied.

Impact on neighbouring public and facilities		
	No mitigation	**Mitigation**
Extent	Regional	N/A
Magnitude	Very low	N/A
Duration	Long term	N/A
SIGNIFICANCE	**Low (-)**	N/A
Probability	Unlikely	N/A
Confidence	Sure	N/A
Reversibility	Irreversible	N/A

BACTERIA IN COOLING SYSTEM WATER

Although the likelihood of this impact occurring is low, it must be recognised and controlled. Its extent would be local and the magnitude would be high if it were to occur and impact on humans. Its duration would be long term, i.e. for the life of the mine/acid plant. The possible impact of Legionnaire's disease is thus regarded as being of medium negative significance.

Mitigation measures

Additional mitigation measures that should be considered include minimising water stagnation and process leaks, maintaining system cleanliness by disinfection, using scale and corrosion inhibitors where appropriate and efficient mist eliminators on cooling towers. In this way, the significance of the impact can be reduced to a very low negative.

Impact on human health from *Legionella pneumophila* bacteria in cooling system water		
	No mitigation	**Mitigation**
Extent	Local	Local
Magnitude	High	Very low
Duration	Long term	Long term
SIGNIFICANCE	**Medium (-)**	**Very low (-)**
Probability	Unlikely	Unlikely
Confidence	Sure	Certain
Reversibility	Irreversible	Irreversible

LONG TERM OCCUPATIONAL HEALTH AND SAFETY

The impact on the occupational health and safety of workers is regarded as local, since its effects would only be felt in close proximity to the acid plant. Its magnitude would be low, since it would slightly alter social functions if it were to occur and it could only occur if prescribed occupational exposure limits for SO_2 were exceeded. Its duration, however, would be long term, i.e. for the life of the mine/acid plant. The significance of the risk to workers' health is thus believed to be negatively low. Note that the air quality study indicated that no respirator zoning would be required.

Mitigation measures

Stringent occupational health and safety standards would be applied by RU at the proposed acid plant as a matter of course. These include purpose-designed engineering measures, e.g. extraction and ventilation and properly selecting and training workers for the acid plant. RU is obliged to comply with all statutory requirements and the standards as adopted. No further mitigation measures are thus considered.

Impact on workers' long term health and safety		
	No mitigation	**Mitigation**
Extent	Local	N/A
Magnitude	Low	N/A
Duration	Long term	N/A
SIGNIFICANCE	**Low (-)**	N/A
Probability	Unlikely	N/A
Confidence	Sure	N/A
Reversibility	Irreversible	N/A

5.3.3 Visual impact

A full copy of the *Landscape Characterisation and Visual Impact Assessment* specialist study report compiled by VRMA is contained in Annexure G of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

The proposed acid plant would include an emission stack of 50 m in height, as described in Section 2.2.2 a) above[21]. Figure 17 provides an example of a similar acid plant for comparative purposes. Although the optimum site for the acid plant is within an already severely changed area and its industrial appearance would not be out of place, the stack may be high enough to intrude above the skyline when viewed from afar. The visual impact assessment therefore determined the receptors[22] which would potentially have sight of the stack and identified key observation points as being along the B2 National Road, along sections of the Rössing Road, and from areas in the Namib Naukluft Park (Welwitschia Flats). Figure 18 illustrates the "visual envelope"[23] of a 50 m stack and Figure 19 provides a graphic representation of its appearance from the B2 National Road.

[21] Note that both 50 m and 75 m stack heights were assessed in the air quality study. Since a 50 m stack height has proved to be acceptable in terms of ground level SO_2 concentrations not affecting workers on site, the 50 m stack has been accepted as the height being assessed in the present SEIA.

[22] A receptor is defined as an individual, group or community who will be subject to the visual influence of a particular project.

[23] A visual envelope is defined as the outline of the area of land within which there is a view of any part of the proposed landscape modification.

Figure 17: Example of a similar acid plant (source: VRMA)

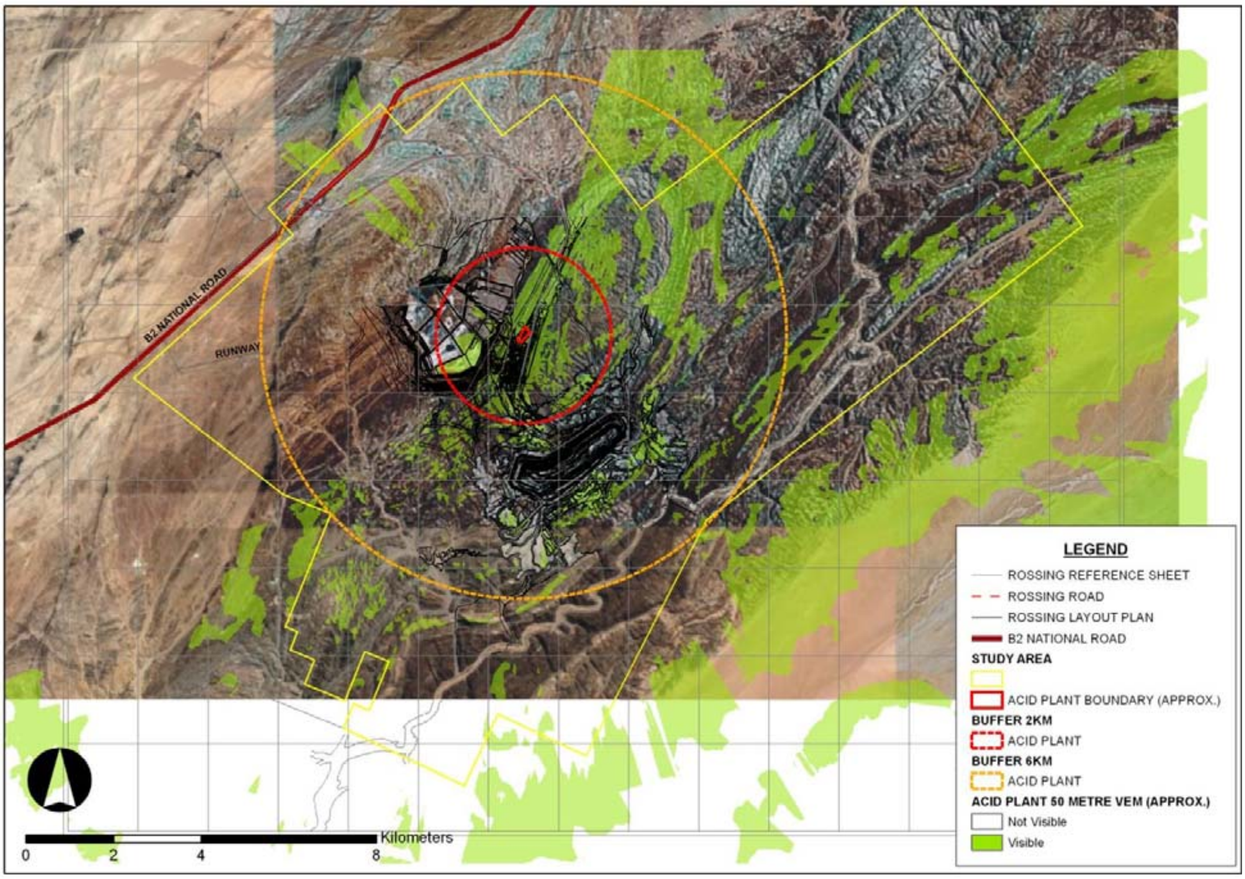

Figure 18: Visual envelope for a 50m stack (source: VRMA)

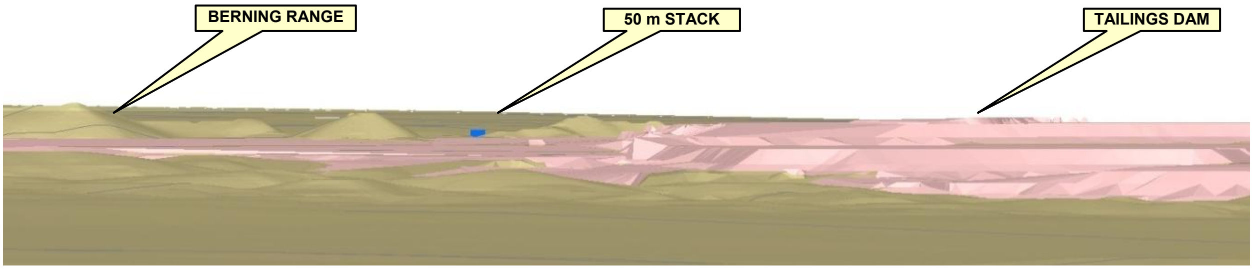

Figure 19: Graphic representation of appearance of stack from the B2 National Road
(source: VRMA)

b) Discussion

As evident from Figure 18 above, the geographical area from which the stack would be visible is limited to people on the mine site, since it is largely screened to the north. It would, however, be visible from areas in the Namib Naukluft Park to the south east, but it would be viewed against the existing mining infrastructure and be absorbed into the landscape more readily.

The extent of this impact is has been interpreted as regional, since the stack would be visible from outside the mine boundary. A low magnitude is believed to be appropriate because the distance to the B2 National Road would make its visibility insignificant. Also, the topography provides a visual screen to the north and the site is within a highly transformed mine processing precinct. The duration is regarded as medium term, since the plant would be removed on mine closure.

The visual impact of the acid plant, and the 50 m high emission stack in particular, is therefore believed to be of a low negative significance.

Mitigation measures

The visual impact assessment in question provides a number of mitigation measures for the acid plant, in terms of finishes and textures, lighting (including warning lights for aircraft) and decommissioning. Where appropriate, these have been taken up in the accompanying SEMP (see Annexure A). However, the assessment table below does not include the evaluation of a post-mitigation situation, since best practice and adherence to air quality standards have determined the optimum design for the acid plant. Further attention to mitigation would not offer additional environmental benefits.

Visual impact of acid plant		
	No mitigation	**Mitigation**
Extent	Regional	N/A
Magnitude	Low	N/A
Duration	Medium term	N/A
SIGNIFICANCE	**Low (-)**	N/A
Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Reversible	N/A

5.3.4 Impact on water resources

A full copy of the *Water Management* specialist study report compiled by Sandra Müller of RU is contained in Annexure H of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

RU have determined that using water is the preferred means of cooling for the acid plant. Approximately 2 500 m^3/day of fresh water would be needed by the acid plant at full production and with the regional bulk supply being increased by the installation of a desalination plant by NamWater, it is assumed that the increased volume needed by RU will be assured. The NamWater desalination plant will be in operation before the acid plant is commissioned.

As far as water quality is concerned, runoff, spillage and effluent from the acid plant will be managed by means of purpose-designed impervious surfaces, bunding and collection sumps. This will allow such effluent to be properly controlled and reused or treated appropriately. It should be noted, however, that the existing acid storage tanks will need to be equipped with a bund and collection sump to control runoff and spillage in that area.

RU has a comprehensive water management system in place that optimises water use and effectively reduces the need for additional water. The management of runoff, spillage and effluent from the acid plant and storage tanks should be incorporated into the present system.

b) Discussion

Based on the assumption that the supply and management of the water needed for the operation of the acid plant accords with the comprehensive water management system RU has in place on the mine, negative impacts from runoff, spillage and effluent can be largely controlled. The extent of possible impact is regarded as local and the magnitude would be low, since, at worst, a slight alteration in natural processes could result. The duration, however, would be long term, since the impact would continue for the life of the mine and beyond.

The impact on water resources is therefore regarded as of low negative significance.

Mitigation measures

Given that RU has effectively managed water use on the mine for some time, e.g. maintaining the level of fresh water used per tonne of processed ore, while increasing the volume of seepage water recovery, additional mitigation measures are not considered. Best water management practices and appropriate technologies are already being applied.

Acid plant's impact on water resources		
	No mitigation	**Mitigation**
Extent	Local	N/A
Magnitude	Low	N/A
Duration	Long term	N/A
SIGNIFICANCE	**Low (-)**	N/A

Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Reversible	N/A

5.3.5 Impact of noise and vibration

The specialist study report titled *Environmental Noise Report: Proposed Infrastructure and Open Pit Expansion at Rössing Uranium Mine* compiled by Namibian Vibration Consultants is included as Annexure I of this report. It forms the basis of the findings presented in this section.

a) Impact Statement

The noise and vibration specialist study began with the measurement of existing ambient noise levels. The ambient noise level measured at the site proposed for the acid plant is in the order of 46 dB(A), which is to be expected within an industrial precinct with continuous processing plant noise in the vicinity. However, information provided by the acid plant manufacturer indicates that up to double the ambient noise at the plant level may be expected once the plant is in operation at this site. While such an increase over ambient noise levels would be unacceptable were the public exposed to it, it is less of an issue within the processing precinct of a large mining operation that applies strict access control and operational procedures that accord with prescribed occupational health and safety standards. Also, in examining current design information for the acid plant, the noise and vibration specialist study indicates that the surface mining activities elsewhere on the mine would produce noise levels significantly higher than those produced by the acid plant. The acid plant would operate both during the day and at night.

b) Discussion

The extent of this impact is regarded as local, since there are no implications beyond the boundary of the mine. When viewed in isolation, however, its magnitude may be regarded as medium, since a notable alteration will result. The duration would be long term, i.e. for the life of the plant/mine. The significance of this impact is thus believed to be of a medium negative nature.

Mitigation measures

The application of noise standards in the workplace is a legal requirement and the South African Department of Environmental Affairs and Tourism's regulations published in terms of Section 25 of the Environment Conservation Act (73 of 1989) are generally applied in Namibia. These were used as a standard for occupational health and safety by the noise and vibration specialists in this case. Together with recommended mitigation measures regarding equipment maintenance and operational procedures, and operator protection enclosures, the significance of this impact can be reduced to a low negative level.

Acid plant's impact on noise levels		
	No mitigation	**Mitigation**
Extent	Local	Local
Magnitude	Medium	Very low
Duration	Long term	Long term
SIGNIFICANCE	**Medium (-)**	**Low (-)**
Probability	Definite	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible

5.3.6 Impact on energy use

A full copy of the *Preliminary Energy Balance for Rössing Uranium Ltd Expansion, including Acid Plant, Ore Sorter Plant and Extension of Mining Activities into SK4* specialist study report compiled by Svenja Garrard of Rio Tinto T&I is contained in Annexure J of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

Since no Namibian standards and policies regarding the management and reporting of greenhouse gas (GHG) emissions are in place, RU has adopted those of its parent company Rio Tinto.

In line with Rio Tinto's adoption of GHG protocols derived from the World Business Council for Sustainable Development and World Resources Institute, RU has been monitoring and reporting on their GHG emissions and energy use since targets were set in 2004 and their contribution to the entire Rio Tinto group's GHG emission and energy use comprises a minor 0.0002 %. The RU target in the short term is to reduce GHG emissions and energy use by 20 % and 23 % respectively, from the baseline of 53.7 tonnes of CO_2 equivalent per annum (t CO_2-e/a), per tonne of U_3O_8 produced. However, this target has had to be revised due to it being based on the situation prior to the consideration of an extension of the life of the mine.

As far as GHG emissions and energy use related to the acid plant are concerned, these would largely result from energy use, although an insignificant amount of diesel fuel will be required for start-up. Operation of the plant would require an electricity supply of 4.5 MW but the considerable amount of electricity generated from the heat produced by the acid production process (14.5 MW gross) would offset this. A decrease below the 2006 values of GHG emissions of 25 % and energy use (measured as GJ/a) of 22 % is thus projected.

Consideration has also been given to the reduction in current GHG emissions derived from the importation and transport of sulphuric acid to the mine. With acid being produced on the mine, i.e. elemental sulphur being imported and transported to the mine instead, a 26 % reduction in GHG emissions is projected (from 32 285 t CO_2-e/a to 19 304 t CO_2-e/a).

b) Discussion

The extent of this impact is regarded as regional, since it ultimately has global connotations. Natural functions would be negligibly altered, due to the positive nature of the reduction of GHG emissions and energy use, and a very low magnitude would result. The duration would be long term, since it would last for the life of the mine. A positively low significance would thus result from this impact.

Mitigation measures

No mitigation measures are being considered, since RU has a comprehensive and on-going programme of GHG emission and energy use monitoring and reduction in place.

Impact of energy use by acid plant		
	No mitigation	**Mitigation**
Extent	Regional	N/A
Magnitude	Very low	N/A
Duration	Long term	N/A
SIGNIFICANCE	**Low (+)**	N/A
Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Reversible	N/A

5.4 OPERATIONAL PHASE IMPACTS OF THE ORE SORTER PLANT AND ASSOCIATED REJECT ROCK DISPOSAL

5.4.1 Impact on air quality

A full copy of the specialist study report titled *Air Quality Impact Assessment for the Proposed Expansion Project for Rössing Uranium Mine in Namibia: Phase 1* compiled by Airshed Planning Professionals is contained in Annexure D1 of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

The installation of the proposed ore sorter plant and disposal of reject rock would result in fugitive dust emissions that may impact on workers on the site and on residential areas further afield. Besides examining the operation of the plant in terms of fugitive dust, the transport of reject rock by means of truck or conveyor to four alternative disposal sites was also considered. Dispersion modelling was undertaken for these different situations, after the baseline conditions and an emissions inventory had been prepared. The dispersion modelling has thus allowed for the prediction of the impacts of airborne dust on human health. Such impacts are dependent on the characteristics of the dust particles in terms of size and chemical composition, as well as the duration, frequency and magnitude of exposure.

Namibia has adopted the current and proposed South African air pollution legislation, as determined by the air quality specialist when reviewing relevant legal requirements. The specialist study, however, used a variety of national and international air quality standards, to ensure a comprehensive and defendable understanding of such requirements. The limits against which the predicted dust emissions, termed inhalable particulates (PM10), were compared were thus the South African Air Quality Act and SANS standards, the World Bank Group and World Health Organisation (WHO) guidelines, the European Community (EC) limits and the standards prescribed in the United Kingdom and USA.

The findings of the study show that the highest predicted daily levels as well as the annual average levels of PM10 concentrations for the various transportation alternatives, i.e. to any of the four possible sites and whether by truck or conveyor, do not differ. These levels accord with the current South African standard. Nevertheless, according to the EC daily PM10 limit, the combined levels from all sources are approaching the allowed 35 occurrences per year of concentrations greater than 50 $\mu g/m^3$ at the mine boundary. The highest daily PM10 concentration of 30 $\mu g/m^3$ predicted for the ore sorter plant itself, however, is well with the prescribed standard of 10 000 $\mu g/m^3$.

The most important contributor to PM10 concentrations is from dust entrained by vehicle movement on unpaved roads. It is also important to note that the major proportion of dust caused by vehicles is predicted to be from the haulage of ore from the SK4 pit to the primary crusher, as described in Section 5.5.1. Fugitive dust from the ore sorter plant may be effectively controlled by means of filters within baghouses at identified emission points within the plant.

b) Discussion

This impact is regarded as regional in extent, since exceedences of PM10 concentrations may occur at the mine boundary. Because the exceedances are predicted to be minimal and thus cause a slight alteration to existing conditions, the magnitude is believed to be low. The duration would, however, be long term, given that the intention is for the plant to operate for the life of the mine. The significance of this impact is therefore regarded as negatively medium.

Mitigation measures
Mitigation measures in the form of hardening and better binding of road surfaces and restricting traffic volumes and speed can reduce the magnitude of this impact and limit its extent to within the mine boundary.

Impact of ore sorter plant on air quality		
	No mitigation	**Mitigation**
Extent	Regional	Local
Magnitude	Low	Low
Duration	Long term	Long term
SIGNIFICANCE	**Medium (-)**	**Low (-)**
Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Reversible	Reversible

5.4.2 Impact on human health

a) Impact Statement

Additional sources of dust emission would result from the installation of the proposed ore sorter plant and the disposal of reject rock. Such dust would be radioactive and, together with the release of radon gas, pose a potential radiological inhalation hazard to employees on site as well as the public further afield. Sources of radioactive dust and radon gas would be from fugitive dust from materials handling at the sorter plant itself, as well as from the transport to and disposal of reject rock at the dump site.

The current situation regarding levels of radiation originating from the various operations on the mine are well understood and controlled. Personal dust monitors are carried by selected personnel working in areas where such exposure occurs and long term monitoring of radiological hazard is thus in place. There are 963 such monitors in use on the mine. RU is following the standards adopted by the International Atomic Energy Agency (IAEA) which are based on the recommendations from the International Council for Radiological Protection. These IAEA standards set a public dose limit of 1 mSv per year (with a dose constraint of 0.3 mSv in cases where cumulative radiological impacts are expected in the region) and a worker dose limit of a total of 100 mSv over a defined 5 year period (which relates to an average of 20 mSv per year) with a maximum allowable dose of 50 mSv per year. These allowed exposures refer to the radiation doses arising from an operation. As Rössing mine is a well controlled low uranium grade mine, these standards have never been exceeded in the past.

An earlier assessment of the ore sorter plant, undertaken in 2001 by EnviroSolutions (EnviroSolutions 2001), addressed the possible increase in grade of ore passing through the plant and the consequent increase in radiation exposure on the part of plant personnel. The increase was however regarded as low, at between 0.9 and 1.87 mSv/a, and would remain well below the ICRP annual dose limit of 20 mSv per annum.

A dose assessment for the entire life of mine extension was carried out in 2008 by NECSA[24] and a copy of their report is included for information as Annexure D2. The study was to determine the significance of the change in exposure caused by the expected additional dose compared to the existing dose. This study was not specific about the radiological implications of the ore sorter plant and reject rock handling. However, the understanding of the dispersion of dust emissions from these sources, derived from the air quality study reported in Section 5.4.1 above, allows inferences to be made when the findings of the NECSA study, that expected public doses from atmospheric radiological emissions will remain below the dose constraint of 300 µSv/a, are considered. On balance, the proportion of radiological emission derived from the ore sorter plant and reject rock handling is of an amount that is small enough not to pose public or worker dose risks that are out of keeping with the overall findings of the probabilistic assessment undertaken by NECSA for the entire life of mine project. The level of radiological risk from the ore sorter plant and reject rock handling is thus regarded as acceptable. Note that Phase 2 of the SEIA for RU's expansion project will re-examine the issue of radiological emissions in more appropriate detail.

b) Discussion

The extent of this impact is regarded as regional, since the effects may be felt beyond the mine boundary. Its magnitude is believed to be very low, given that public and worker doses are well within prescribed limits. The impact would last for the life of the mine and the duration is thus regarded as long term. The impact of radiological exposure is therefore of low negative significance.

Mitigation measures

While long term mitigation measures have been investigated for the post closure of the mine, these do not relate specifically to the ore sorter plant and reject rock disposal.

Impact of ore sorter plant on radiological exposure		
	No mitigation	**Mitigation**
Extent	Regional	N/A
Magnitude	Very low	N/A
Duration	Long term	N/A

[24] *Dose Assessment for a Life-of-Mine Extension (LoME) of the Rössing Uranium Mine.* Rev 1 NECSA (GP de Beer & GR Liebenberg), 31 January 2008

SIGNIFICANCE	Low (-)	N/A
Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Reversible	N/A

5.4.3 Visual impact

A full copy of the *Landscape Characterisation and Visual Impact Assessment* specialist study report compiled by VRMA is contained in Annexure G of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

The proposed ore sorter plant described in Section 2.2.2 b) above would be located in an area between the mining operations and the processing plant that has been largely transformed. Its industrial appearance would thus not be out of place in its immediate setting and the decision to adopt a horizontal arrangement of pre-screening units means that its height would not pose substantial visual intrusion above the skyline when viewed from afar. However, the visual impact assessment determined the receptors which would potentially have sight of the plant and identified key observation points as being RU employees on the Rössing Road, and from areas in the Namib Naukluft Park. Figure 20 illustrates the "visual envelope" compiled in this way.

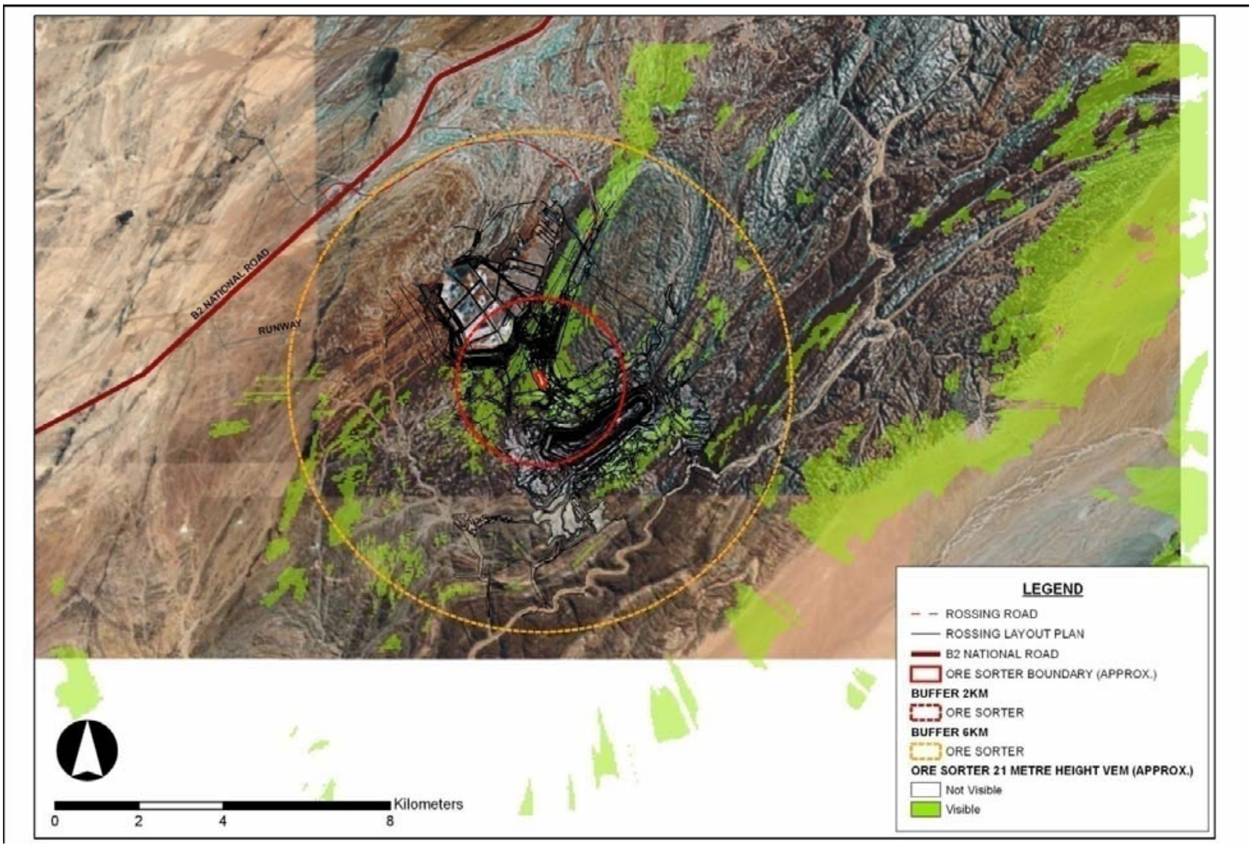

Figure 20: Visual envelope for proposed radiometric ore sorter (source: VRMA)

Note that the visual impact assessment was not applied to the reject rock disposal sites, since the evaluation of these alternatives has been undertaken at a nominal level and graphic representations of the alternatives are not available for visual assessment. The visual impact assessment does, however, recommend that a specific study be undertaken when more comprehensive attention is given to the spatial impacts of additional tailings, waste rock disposal and heap leaching as described in Section 5.4.6 a), during the pending Phase 2 SEIA.

b) Discussion

As evident from Figure 20 the geographical area from which the ore sorter plant would be particularly visible is limited to people on the mine site or approaching the mine on the Rössing Road. It would, however, be visible from afar from areas in the Namib Naukluft Park, but it would be viewed against the existing mining infrastructure and be absorbed into the landscape more readily.

The extent of this impact is regarded as local, since the plant would only be plainly visible from on or approaching the mine. A low magnitude is believed to be appropriate because the scenic quality of the surroundings will not be undermined and the mine's visibility will not become larger. The duration is regarded as medium term, since the plant would be removed on mine closure. The visual impact of the ore sorter plant is therefore believed to be of a low negative significance.

Mitigation measures

The visual impact assessment in question provides a number of mitigation measures for the ore sorter plant, in terms of finishes and textures, lighting, dust control and decommissioning. Where appropriate, these have been taken up in the accompanying SEMP (see Annexure A). However, the assessment table below does not include the evaluation of a post-mitigation situation, since best practice has determined the optimum design for the ore sorter. Further attention to mitigation would not offer additional environmental benefits.

Visual impact of ore sorter		
	No mitigation	**Mitigation**
Extent	Local	N/A
Magnitude	Low	N/A
Duration	Medium term	N/A
SIGNIFICANCE	**Low (-)**	N/A
Probability	Definite	N/A
Confidence	Sure	N/A
Reversibility	Reversible	N/A

5.4.4 Impact on water resources

A full copy of the *Water Management* specialist study report compiled by Sandra Müller of RU is contained in Annexure H of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

Implications for water use by the ore sorter plant are related to dust suppression. An amount of 72 m^3/day is estimated for this purpose. However, very little of this volume is recoverable and a collection sump for this purpose is thus not required. The structures would nevertheless need to be washed down from time to time and a sump may be useful in this case. If deemed necessary, recycled water could be used for washdown purposes.

The most important water-related implication from the ore sorter plant is in terms of the potential impact of reject rock disposal. Small quantities of nitrate, sulphate and uranium from waste rock dumps may contaminate groundwater. Section 5.4.6 addresses the location of the required reject rock disposal site and water quality is used as one of the critical informants in identifying an environmentally acceptable site. Note that on-going monitoring and modelling of groundwater contamination is conducted by RU and additional information will thus become available in the near future. There are also cumulative impacts associated with groundwater as a regional resource.

b) Discussion

Given the very small amount of water required for dust suppression, the assessment table that follows addresses the issue of water quality related to reject rock dump disposal.

Since contaminated groundwater may infiltrate beyond the boundary of the mine, the impact is regarded as regional. The magnitude of the impact is regarded as low, since such contamination may result in slight alteration to ecological processes. The impact will diminish over time as the soluble salts are removed from the waste dumps with each rainfall event and the duration of the impact is thus believed to be medium term. This impact is therefore regarded to be of low negative significance.

Mitigation measures

A mitigation measure that may be considered is the location of the reject rock dump in an area already managed by control systems. In this way, existing seepage control systems would minimise the impact. The enlargement or modification of such seepage control systems may further reduce the impact.

Ore sorter's impact on water resources		
	No mitigation	**Mitigation**
Extent	Regional	Regional
Magnitude	Low	Very low
Duration	Medium term	Medium term
SIGNIFICANCE	**Low (-)**	**Very low (-)**
Probability	Probable	Probable
Confidence	Sure	Sure
Reversibility	Reversible	Reversible

5.4.5 Impact of noise and vibration

The specialist study report titled *Environmental Noise Report: Proposed Infrastructure and Open Pit Expansion at Rössing Uranium Mine* compiled by Namibian Vibration Consultants is included as Annexure I of this report. It forms the basis of the findings presented in this section.

a) Impact Statement

Using the pilot ore sorter plant as representative of the type of plant to be installed, noise levels of between 77.5 dB(A) and 85.0 dB(A) were measured. Indications are thus that the ore sorter plant would produce noise at levels that are the same as surface mining activities elsewhere on the mine. Indeed, once surface mining progresses below ground-level, noise derived from the ore sorter plant will become the dominant continuous noise source on the mine. While such high noise levels would be unacceptable were the public to be exposed to them, it is less of an issue within the processing precinct of a large mining operation that applies strict access control and operational procedures that accord with prescribed occupational health and safety standards. The ore sorter plant would operate both during the day and at night.

b) Discussion

The extent of this impact is regarded as local, since there are no implications beyond the boundary of the mine. When viewed in isolation and without prescribed mitigation measures in place, however, its magnitude should be regarded as high, since a severe alteration may result. The duration would be long term, i.e. for the life of the plant/mine. The significance of this impact is thus believed to be of a high negative nature.

Mitigation measures

The application of noise standards in the workplace is a legal requirement and the South African Department of Environmental Affairs and Tourism's regulations published in terms of Section 25 of the Environment Conservation Act (73 of 1989) are generally applied in Namibia. These were used as a standard for occupational health and safety by the noise and vibration specialists in this case. Together with recommended mitigation measures regarding the design of source damping acoustic treatment and acoustic enclosure, applying strict operational procedures such as equipment maintenance could reduce the significance of this impact to a low negative level.

Ore sorter plant's impact on noise levels		
	No mitigation	**Mitigation**
Extent	Local	Local
Magnitude	High	Low
Duration	Long term	Long term
SIGNIFICANCE	**High (-)**	**Low (-)**
Probability	Definite	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible

5.4.6 Impact of reject rock disposal

a) Impact Statement

As described in Section 2.2.2 b) above, RU has undertaken studies in the past to identify possible sites for the disposal of reject rock from the ore sorter plant. Seven alternatives were considered in the most recent study (Rio Tinto Technical Services, 2005). The current status of these seven sites (see Figure 15 above) is as follows:

- The tailings dam: constrained by the need to manage the tailings dam but acceptable in terms of water quality;
- Below the southern toe of the tailings dam: constrained by the need to manage the tailings dam seepage and thus unacceptable in terms of water quality;
- The valley and areas adjacent to the grit-blasting yard: no spatial constraints and acceptable in terms of water quality;
- The mine waste dump designated *Waste 5*: constrained by limiting the exploitation of ore but acceptable in terms of water quality;
- The upper area of Dome Gorge: initially though to foreclose on possible sites for heap leaching but more recent thinking is that the Dome area could provide space for a combination of other uses (tailings, waste rock and heap leaching). Nevertheless constrained in terms of water quality;
- Northwest of the salvage yard on the slopes of the Berning Range: constrained by visual impact and existing infrastructure, and unacceptable in terms of water quality; and
- South of the Seepage Dam access road: constrained by limiting the exploitation of ore but partly acceptable in terms of water quality.

To better understand the implications of available alternatives for reject rock disposal, it should be noted that the air quality study considered the impact of dust from the transport of such material, either by conveyor or by truck. Four areas were evaluated, approximating the initial options west of the ore sorter plant and the Dome site, but also including the use of existing waste sites. The findings were essentially that no major advantages would result from any one of these options.

The energy balance study of the ore sorter plant and reject rock disposal examined the scenarios of transport by conveyor and by truck. The conveyor option assumed that a nearby waste site would be used, while the trucking option assumed that the furthest waste site would be used. The differences in GHG emissions and energy use between these options are not substantial enough to warrant adopting only one or the other.

Considering the status of the initial sites identified as alternatives, after the spatial and water quality constraints mentioned above are included, and recognising that air quality and energy balance are not major factors, two alternatives remain. These are the valley and areas adjacent to the grit-blasting yard to the west of the ore sorter plant, and the use of existing waste areas that can accommodate additional material. See Figure 15 for the location of the grit-blasting yard valley (Location C) and Figure 21 for the location of existing waste rock dump sites. It is important to note that this recommendation is based on the fact that later components of RU's expansion plan will require considerably more space for tailings, waste rock and heap leaching, i.e. to be examined during the pending Phase 2 SEIA described previously in this report. The approach being recommended here is thus that a short to medium term option for reject rock disposal is found for this Phase 1 SEIA, that is acceptable from environmental, capacity and engineering cost points of view. Given that a more holistic assessment of the availability of space for the Phase 2 components will be necessary, integrating the need for reject rock disposal with a more comprehensive and site-wide assessment at that time will result in a more sustainable solution being found.

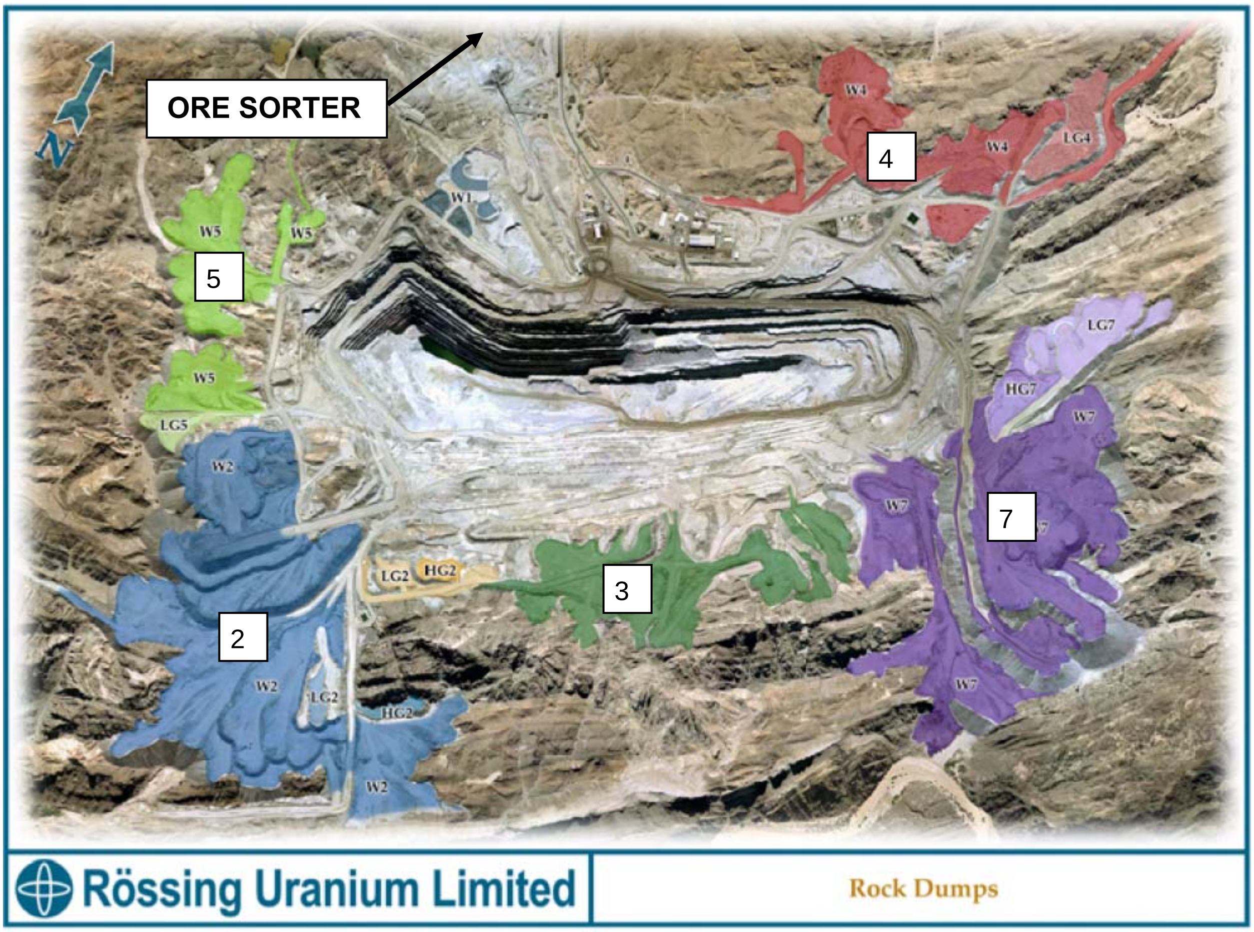

Figure 21: Existing waste rock dumps (source: RU)

For the purposes of this study, therefore, two alternatives have been evaluated. The indicators used in comparing the two alternatives are based on the generic impacts expected from an activity of this nature. A simple tabulation is presented below that rates the indicators, i.e. those factors that can be compared against each other in such a way that a preference is apparent, applied to the two alternatives on a nominal scale of low, medium or high, and whether the impact would be positive or negative. Note that for comparison purposes the impacts are all regarded as negative and their differentiation is essentially between medium and low.

Alternatives → Indicators ↓	Grit blasting yard valley		Existing waste dumps	
Transport cost: distance	Low (-)		Medium (-)	
Engineering cost: site access & preparation	Medium (-)		Low (-)	
Infrastructure conflict	Medium (-)		Low (-)	
Occupational health & safety	Low (-)		Low (-)	
Visual impact	Medium (-)		Medium (-)	
Biodiversity	Medium (-)		Low (-)	

Table 6: Rating of the two waste rock disposal alternatives for rock from the ore sorter

At this nominal level of evaluation, the use of existing waste dumps appears to be preferable. This approach would also fit with the need for a more comprehensive and site-wide assessment of the spatial and land use requirements of the entire expansion project.

b) Discussion

As far as suitable space is concerned, this impact is regarded as local for both alternatives. The grit blasting yard valley has constraints related to engineering cost, infrastructure conflict, possible visual impact and a slight biodiversity implication, the last-mentioned due to the area not having been completely modified by mining activities. The impact of using the grit blasting yard valley is therefore regarded as of medium magnitude. Using existing waste dumps has fewer such constraints and is regarded as of low magnitude. The duration of the impact is long term in both cases, regardless of other reject rock disposal opportunities in the future. The grit blasting yard valley alternative is therefore believed to be of medium negative significance, while the use of existing waste dumps would have a low negative impact significance.

Mitigation measures

No mitigation measures are being considered, given the nominal level of evaluation and short to medium term nature of the operation.

Impact of reject rock disposal				
	Grit blasting yard valley		Existing waste dumps	
	No mitigation	Mitigation	No mitigation	Mitigation
Extent	Local	N/A	Local	N/A
Magnitude	Medium	N/A	Low	N/A
Duration	Long term	N/A	Long term	N/A
SIGNIFICANCE	**Medium (-)**	N/A	**Low (-)**	N/A
Probability	Definite	N/A	Definite	N/A
Confidence	Certain	N/A	Certain	N/A
Reversibility	Irreversible	N/A	Irreversible	N/A

5.4.7 Impact on energy use

A full copy of the *Preliminary Energy Balance for Rössing Uranium Ltd Expansion, including Acid Plant, Ore Sorter Plant and Extension of Mining Activities into SK4* specialist study report compiled by Svenja Garrard of Rio Tinto T&I is contained in Annexure J of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

See Section 5.3.7 a) above for a wider contextualisation of this impact.

As far as GHG emissions and energy use related to the operation of the ore sorter plant are concerned, these would result mainly from the electricity needed for the high pressure air used to physically reject unwanted rocks, and their transportation to a waste disposal site. The electricity requirement is projected to be 4,3 MW, although this figure is offset by the 1,8 MW that the current pilot ore sorter plant uses.

As far as the transportation of rejected rock is concerned, the final identification of suitable disposal sites is the subject of the present SEIA. Section 5.4.6 above addresses the issue in particular but for the purpose of the assessment of energy use, a worst-case scenario has been considered.

Both electricity and diesel consumption have been examined, as well as inputs from the presence of additional personnel required to operate the plant. An increase over the 2006 values of GHG emissions of 22 % to 23 % and energy use (measured as GJ/a) of 29 % is projected.

b) Discussion

The impact would be regional in extent, since the issue ultimately has global connotations. The magnitude is regarded as low since natural functions would be slightly altered. The impact would last for the life of the mine and the duration is thus regarded as long term. This impact is therefore believed to be of a medium negative significance.

Mitigation measures

No mitigation measures are being considered, since RU has a comprehensive and on-going programme of GHG emission and energy use monitoring and reduction in place.

Impact of energy use from ore sorter plant		
	No mitigation	**Mitigation**
Extent	Regional	N/A
Magnitude	Low	N/A
Duration	Long term	N/A
SIGNIFICANCE	**Medium (-)**	N/A
Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Reversible	N/A

5.5 OPERATIONAL PHASE IMPACTS OF MINING THE SK4 ORE BODY

5.5.1 Impact on air quality

A full copy of the specialist study report titled *Air Quality Impact Assessment for the Proposed Expansion Project for Rössing Uranium Mine in Namibia: Phase 1* compiled by Airshed Planning Professionals is contained in Annexure D1 of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

The mining of the SK4 ore body and haulage of ore to the primary crusher would result in dust emissions and the blasting would release carbon monoxide (CO) and hydrogen sulphide (H_2S) that may impact on workers on the site and on residential areas further afield. Determining whether the predicted levels of these emissions comply with prescribed standards was undertaken, after the baseline conditions and an emissions inventory had been prepared.

In determining relevant legal requirements, the air quality specialist determined that Namibia has adopted the current and proposed South African air pollution legislation. The specialist study, however, used a variety of national and international air quality standards, to ensure a comprehensive and defendable understanding of such requirements. The limits against which the predicted dust, CO and H_2S emissions were compared were the South African Air Quality Act and SANS standards, the World Bank Group and World Health Organisation (WHO) guidelines, the European Community (EC) limits and the standards prescribed in the United Kingdom and USA.

Dust emissions from drilling and blasting are intermittent and are measured as kilogrammes of dust per hole drilled or blast event. Total suspended particulate loads and PM10 emissions were calculated from information provided regarding the proposed drilling and blasting plan. The US-EPA standards adopted for highest hourly CO and H_2S levels were examined in the comparison with predicted levels of these pollutants.

b) Discussion

Using the South African target level of 600 mg/m^2/day for dust fallout from blasting, and a maximum deposition at the mine boundary of 60 mg/m^2/day, this impact is well within the adopted standards. Note, however, that haulage by truck to the primary crusher would be a major contributor to the dispersion of PM10 particulates as described in Section 5.4.1. According to the EC daily PM10 limit, the combined levels from all sources are approaching the allowed 35 occurrences per year of concentrations greater than 50 µg/m^3 at the mine boundary As far as CO and H_2S emissions from blasting are concerned, these are barely measurable at the mine boundary. Dispersion modelling was applied in this case and the predicted CO and H_2S levels were several orders of magnitude below the adopted standards.

This impact on air quality from the mining of SK4 is regarded as regional in extent, since dust fallout in particular could have consequences beyond the mine boundary. The magnitude is believed to be medium, since natural and social functions and processes would be notably altered. The duration would be for the life of the SK4 pit, i.e. three years, and thus short term. The impact is therefore regarded as being of medium negative significance.

Mitigation measures
Given the insignificant effect of CO and H_2S emissions, no mitigation is required in this case. However, mitigation measures for dust fallout in the form of wet or chemical suppression may be applied. The potential for mitigating the air quality impacts related to the mining of SK4 could thus reduce their significance to a low negative one.

Impact of SK4 mining on air quality		
	No mitigation	**Mitigation**
Extent	Regional	Regional
Magnitude	Medium	Low
Duration	Short	Short
SIGNIFICANCE	**Medium (-)**	**Low (-)**
Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Reversible	Reversible

5.5.2 Impact on human health

a) Impact Statement

The mining of the SK4 ore body, including the pioneering work required in preparation of full production mining and the haulage of ore to the primary crusher, would result in additional sources of dust emissions. Such dust would be radioactive and, together with the release of radon gas, pose a potential radiological inhalation hazard to employees on site as well as the public further afield. Sources of radioactive dust would be from the drilling, blasting and loading activities, and radon gas emission would be derived from exposed surfaces. However, it should be borne in mind that the entrained dust from the transport of ore by truck was identified as a major source of fugitive dust in the air quality study reported in Section 5.5.1 above.

The current situation regarding levels of radiation originating from the various operations on the mine are well understood and controlled. RU is following the standards adopted by the International Atomic Energy Agency (IAEA) which are based on the recommendations from the International Council for Radiological Protection. These IAEA standards set a public dose limit of 1 mSv per year (with a dose constraint of 0.3 mSv in cases where cumulative radiological impacts are expected in the region) and a worker dose limit of a total of 100 mSv over a defined 5 year period (which relates to an average of 20 mSv per year) with a maximum allowable dose of 50 mSv per year. These allowed exposures are referring to the radiation doses arising from an operation. As Rössing mine is a well controlled low uranium grade mine, these standards have never been exceeded in the past.

As mentioned in Section 5.4.2, a dose assessment for the entire life of mine extension was carried out in 2008 by NECSA and a copy of their report is included for information as Annexure D2. The study was to determine the significance of the change in exposure caused by the expected additional dose when compared with the existing dose. The NECSA study was not specific about the radiological implications of the mining activities associated with the exploitation of the SK4 ore body. The understanding of the dispersion of dust emissions from these sources, derived from the air quality study reported in Section 5.5.1 above, nevertheless allows an inference to be made when, according to the findings of the NECSA study, expected public doses from atmospheric radiological emissions will remain below the dose constraint of 300 µSv/a. On balance, the proportion of radiological emission derived from the exploitation of the SK4 ore body is of an amount that is small enough not to pose public or worker dose risks that are out of keeping with the overall findings of the probabilistic assessment undertaken by NECSA for the entire life of mine project. This opinion is illustrated by the fact that the area of exposure available for radon emissions, i.e. slopes and benches, from the total extent of the pit that will result from the mining of the SK4 ore body amounts to about 43,2 ha, compared to the 348.2 ha comprising the current SJ pit and the 525,1 ha considered in NECSA's life of mine assessment for 2016. The level of radiological risk from the mining of the SK4 ore body is thus regarded as acceptable.

Phase 2 of the SEIA for RU's expansion project will re-examine the issue of radiological emissions in more appropriate detail, since there will be more significant atmospheric releases.

b) Discussion

The extent of this impact is regarded as regional, since the effects may be felt beyond the mine boundary. Its magnitude is believed to be very low, given that public and worker doses are well within prescribed limits. Although the SK4 ore body is planned to be depleted in three years, the duration of the impact is regarded as long term, since the pit will not be closed. The impact of radiological exposure is therefore of low negative significance.

Mitigation measures

While long term mitigation measures have been investigated for the post closure of the mine, these do not relate specifically to the mining of SK4 and associated ore handling.

Impact of mining SK4 on radiological exposure		
	No mitigation	**Mitigation**
Extent	Regional	N/A
Magnitude	Very low	N/A
Duration	Long term	N/A
SIGNIFICANCE	**Low (-)**	N/A
Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Reversible	N/A

5.5.3 Visual impact

A full copy of the *Landscape Characterisation and Visual Impact Assessment* specialist study report compiled by VRMA is contained in Annexure G of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

The SK4 ore body is located in an area to the east of the existing open pit and adjacent to the *Waste 7* rock dump. It is intended to use the latter for waste rock from the SK4 pit. Although its south eastern edge is within 50 m of the toe of *Waste 7*, the site does not display the same degree of transformation that the acid plant and ore sorter plant sites do.

The haul road required to transport ore from the proposed SK4 pit to the primary ore crusher, which includes a ramp over minor drainage lines, and the existing Waste 7 rock dump where waste rock from the SK4 pit would be dumped, were also considered in the visual impact assessment. However, due to the absence of alternatives for these project actions, a single assessment table that synthesizes the related visual impacts is provided. It should be noted, however, that the visual impact assessment report cautions against excessive elevation of the Waste 7 rock dump. The visual impact assessment determined that the receptors who might have sight of the SK4 pit would be RU employees on the mine itself and from afar only by people in areas in the Namib Naukluft Park. Figure 22 illustrates the visual envelope compiled in this way.

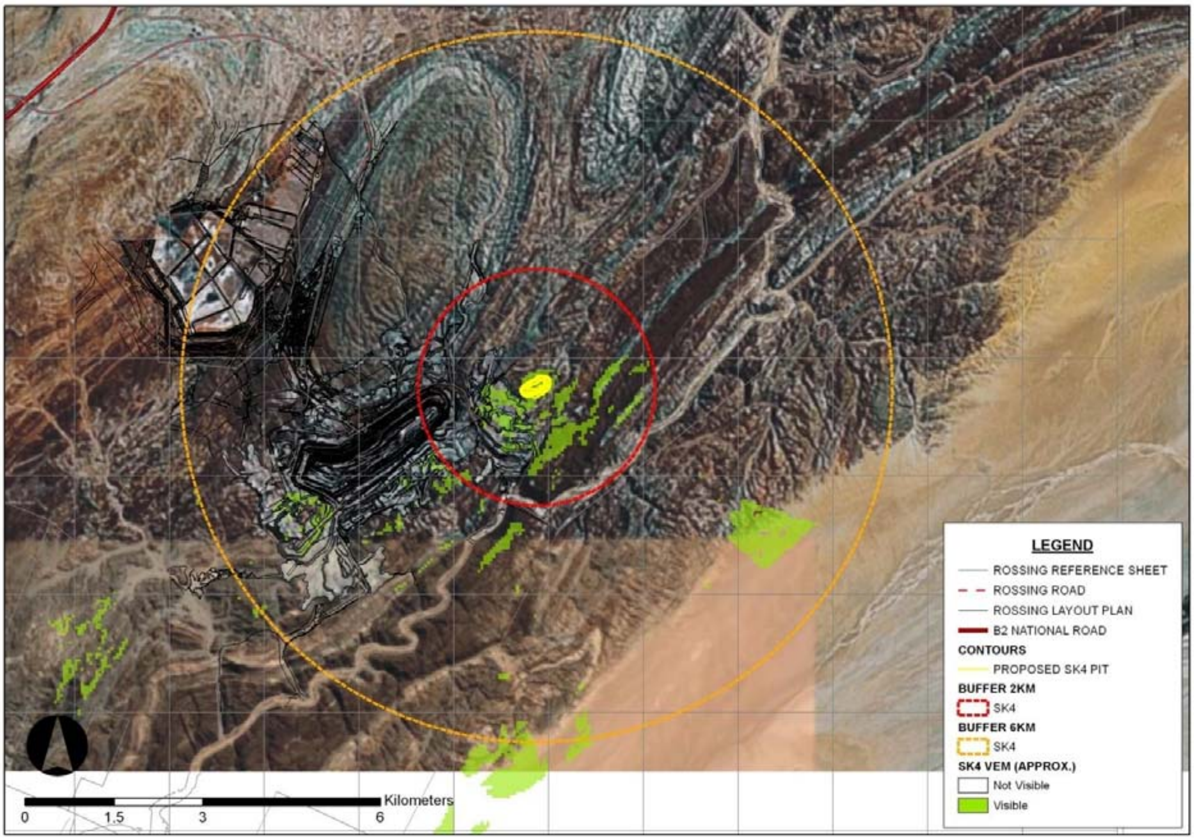

Figure 22: Visual envelope for proposed SK4 pit (source: VRMA)

b) Discussion

As evident from Figure 22 above, the geographical area from which the SK4 pit would be particularly visible is limited to people in close proximity on the mine site. Being RU employees or contractors, such people would have an expectation of being in a highly modified environment. It would, however, be visible from afar from areas in the Namib Naukluft Park, but it would be viewed against the existing mining infrastructure and be absorbed into the landscape more readily. The geographical areas in the Namib Naukluft Park from which the SK4 pit would be visible are also comparatively small and visitor numbers to those parts of the park are limited.

The extent of this impact is regarded as local, since the pit would only be plainly visible from relatively close-by on the mine. The magnitude of this impact is believed to be low, since the site is isolated and also in proximity to existing landscape modifications. The duration is regarded as permanent, since the pit is unlikely to be filled on mine closure. The visual impact of the SK4 pit is therefore interpreted to be of a low negative significance.

Mitigation measures

The visual impact assessment in question provides a number of mitigation measures for the mining of the SK4 pit, in terms of the utilisation and management of rock dumps, dust control, lighting and decommissioning. Where appropriate, these have been taken up in the accompanying SEMP (see Annexure A). However, the assessment table below does not include the evaluation of a post-mitigation situation, since best practice has determined the optimum design for the SK4 pit. Further attention to mitigation would not offer additional environmental benefits.

Visual impact of the SK4 pit		
	No mitigation	**Mitigation**
Extent	Local	N/A
Magnitude	Low	N/A
Duration	Long term	N/A
SIGNIFICANCE	**Low (-)**	N/A
Probability	Definite	N/A
Confidence	Sure	N/A
Reversibility	Reversible	N/A

5.5.4 Impact on water resources

A full copy of the *Water Management* specialist study report compiled by Sandra Müller of RU is contained in Annexure H of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

Water for dust suppression will be required for the mining activities related to the SK4 ore body. Although industrial-quality water is used for this purpose on the mine, a major proportion of which is derived from groundwater abstracted from the Khan River, no additional quantity can be abstracted from this source, since the sustainable yield would be exceeded. Other sources of industrial-quality water are from sewage effluent and seepage water collection. The sum of all these sources amounts to between 1 300 and 1 500 m^3/day. However, this is not sufficient to provide all the dust suppression needs for the mine and an annual shortfall of 0.26 Mm^3 will have to be met.

As mentioned previously in Section 5.3.4 regarding the acid plant, the regional bulk supply will be increased by the desalination plant planned by NamWater and this will provide for RU's additional demand. However, mining the SK4 ore body and increasing mining activity in the existing SJ pit will occur prior to the regional bulk supply from NamWater becoming available. This will contribute to the earlier depletion of the existing regional supply from the Omdel aquifer.

b) Discussion

The extent of this impact is regarded as regional, since the effects would be felt on a resource that large parts of the Erongo Region are dependent on. Its magnitude is regarded as high, since natural and social functions and processes could be severely affected. The duration of the impact, however, would be short term until the increased NamWater bulk supply becomes available. This impact is thus regarded as of medium negative significance.

Mitigation measures
Mitigation measures that would offset the additional demand that RU are considering include reducing the rate of evaporation from the tailings dam, installing more efficient seals on the tailings slurry pumps and using recycled water for dust control at the fine crushers and leach tanks. Water savings of about 2 000 m^3/day could be achieved by applying these measures.

Impact on water management from mining SK4		
	No mitigation	**Mitigation**
Extent	Regional	Regional
Magnitude	High	Low
Duration	Short term	Short term
SIGNIFICANCE	**Medium (-)**	**Low (-)**
Probability	Definite	Definite
Confidence	Sure	Sure
Reversibility	Reversible	Reversible

5.5.5 Impact of noise and vibration

The specialist study report titled *Environmental Noise Report: Proposed Infrastructure and Open Pit Expansion at Rössing Uranium Mine* compiled by Namibian Vibration Consultants is included as Annexure I of this report. It forms the basis of the findings presented in this section.

a) Impact Statement

Mining the SK4 ore body would result in both continuous noise from drilling, loading and haulage activities, as well as the transient noise from blasting that has different propagation properties. Mining activities would occur both during the day and at night.

Sound measurements taken of existing drilling and loading activities have indicated a predicted combined value of 83.5 dB(A) at a distance of 30 m. It is also noted that the initial stages of mining, i.e. before it progresses below ground-level, will produce the greatest impact, since no noise screening from the pit wall will be available. A daytime noise limit for rural areas of 45 dB(A) and a night-time limit of 35 dB(A) are prescribed by the South African SANS 10103 code of practice, as also applied in Namibia. Using the SANS 10103 limits, the findings of the specialist noise study are that the daytime noise contour does not extend beyond the prescribed 1 km radius and that the night-time noise contour similarly does not extend beyond the prescribed 2 km radius. These areas are all within the mine boundary and there is no human habitation within these distances.

As far as blasting is concerned, human response depends on the particular blasting regime, the size, depth and type of charge, local topography and the nature of the rock being blasted. Although there are presently no reliable national or global guidelines for accurately predicting human response to blast noise, the opinion is offered that neither the air blast nor the ground vibration will result in damaging effects. The noise impact specialists recognise the startling effect of blasting and vibration on humans and consider the impact as moderate. However, particular concerns have been raised by farmers in the vicinity of the mine, as referred to in Section 3.4. It should be noted that the effect of vibration on structures is well understood and that careful blast design and charge specification can significantly reduce the impacts.

RU employees that may be exposed to noise and vibration during SK4 mining activities would have to accord with operational procedures that ensure prescribed occupational health and safety standards are met.

b) Discussion

The extent of this impact is regarded as regional, since there are effects felt beyond the boundary of the mine. When viewed in isolation and without prescribed mitigation measures in place, however, its magnitude should be regarded as high, since a severe alteration may result. The duration should be regarded as short term, since the mining of SK4 is projected to be completed in three years. The significance of this impact is thus believed to be of a medium negative nature.

Mitigation measures

The application of noise standards in the workplace is a legal requirement and the South African Department of Environmental Affairs and Tourism's regulations published in terms of Section 25 of the Environment Conservation Act (73 of 1989) are generally applied in Namibia. These were used as a standard for occupational health and safety by the noise and vibration specialists in this case. Together with recommended mitigation measures regarding blast charge calculation, monitoring, early notification, correct stemming of blast holes and maintaining operational procedures, the significance of this impact can be reduced to a low negative level.

SK4's impact on noise levels		
	No mitigation	**Mitigation**
Extent	Regional	Regional
Magnitude	High	Medium
Duration	Short term	Short term
SIGNIFICANCE	**Med (-)**	**Low (-)**
Probability	Definite	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible

5.5.6 Impact of waste rock disposal

a) Impact Statement

In the order of 20 Mt of waste rock will need to be disposed of as a result of the exploitation of the SK4 ore body over a three year period. This amounts to about 18 000 t/d of waste rock and space is available on the *Waste 7* site to accommodate this. The rate of waste rock disposal from the existing SJ pit during 2007 was 59 000 t/d but it should be noted that the mining of SK4 would not be in addition to existing operations but would rather replace part of the present volume of ore feedstock to the processing plant.

One of the existing waste rock dump sites managed as part of the long term mine plan, designated as *Waste 7*, has been earmarked to receive waste rock from SK4. *Waste 7* is the closest dump site to SK4, being at the south eastern side of the SJ pit and within 50 m of the southern end of the SK4 ore body, as evident from Figure 6. Haulage costs would thus be kept to a minimum. *Waste 7* will be able to accommodate the volume of material from the SK4 pit and issues related to visual impact and water management have been considered in the relevant sections elsewhere in this report.

b) Discussion

This impact is regarded as local in extent, since it has no spatial implications beyond the mine boundary. Because the effects would be slight insofar as current impacts from rock dumping are concerned, its magnitude is believed to be low. Considering the limited time period in which the mining of SK4 is planned to take place, its duration may be regarded as short to medium term. The impact significance of the disposal of waste rock to the designated waste site is therefore believed to be negatively low.

Mitigation measures

No mitigation measures are being considered, since the disposal of waste rock from the SK4 pit has been designed to fit in with the existing mine plan for such disposal. There are no additional measures that would bring particular environmental benefit over the current operation. It should be noted, however, that other components of the mine expansion plan indicate the need for additional space for waste rock and tailings disposal in the future. The issue will receive detailed attention in the Phase 2 SEIA process, as described in Section 1.1 above.

Impact of waste rock disposal from SK4		
	No mitigation	**Mitigation**
Extent	Local	N/A
Magnitude	Low	N/A
Duration	Short/medium term	N/A
SIGNIFICANCE	**Low (-)**	N/A
Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Irreversible	N/A

5.5.7 Impact on energy use

A full copy of the *Preliminary Energy Balance for Rössing Uranium Ltd Expansion, including Acid Plant, Ore Sorter Plant and Extension of Mining Activities into SK4* specialist study report compiled by Svenja Garrard of Rio Tinto Plc is contained in Annexure J of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

See Section 5.3.7 a) above for a contextualisation of this impact.

As far as GHG emissions and energy use related to mining the SK4 ore body are concerned, these would result from drilling, blasting, loading, hauling and dumping activities, and mainly derived from fuel usage since electricity will not be provided to the site. All the mobile plant required to mine SK4 were considered, as well as other sources from the presence of additional personnel. An increase over the 2006 values of GHG emissions of 7% and energy use (measured as GJ/a) of 13% is projected.

b) Discussion

The impact would be regional in extent, since the issue ultimately has global connotations. The magnitude is regarded as low since natural functions would be slightly altered. The impact would last for the life of the mine and the duration is thus regarded as long term. This impact is therefore believed to be of a medium negative significance.

Mitigation measures
No mitigation measures are being considered at present.

Impact of energy use from mining SK4		
	No mitigation	**Mitigation**
Extent	Regional	N/A
Magnitude	Low	N/A
Duration	Long term	N/A
SIGNIFICANCE	**Medium (-)**	N/A
Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Reversible	N/A

5.5.8 Impact on biodiversity and archaeology of SK4 site

A full copy of the specialist study report titled *Rössing Biodiversity Assessment* compiled by Environmental Evaluation Associates of Namibia is contained in Annexure K of this SEIA Report. It forms the basis of the findings presented in this section. Dr Antje Burke's report on biotope mapping (Burke, 2007), as referred to in the biodiversity specialist study report, is also included in Annexure K. Information pertaining to archaeology and heritage resources was derived from earlier specialist study reports compiled on RU's behalf by Quaternary Research Services, in particular the report dealing with the SK area (Quaternary Research Services, 2007).

a) Impact Statement

Biodiversity work has been carried out at Rössing since 1984 when the State Museum surveyed flora and terrestrial as well as aquatic fauna. Botanical work undertaken by Dr Antje Burke in 2005 and 2007, which included biotope mapping, has been directly incorporated into the present study and the biotope mapping has been an important informant in this more recent work.

The assessment required that animal biodiversity was to be determined both on the mining licence site as well as further afield, to reveal whether species found on the mine site also occur elsewhere. Because of the difficulty of assessing the distribution of all the faunal species, particularly cryptic or rare species, the approach adopted was based on defined habitats. Three broad habitat types have been used, namely rocky hillsides, open plains and watercourses (including aquatic habitats *per se*). Biodiversity sampling sites for the present study were chosen with these in mind and Figure 23 shows the physical location of these as well as the 1984-1985 sampling sites. The taxonomic groups covered by the study included the microflora and microfauna[25] found in biological soil crusts, plants, spiders and other non-insect invertebrates[26], insects, amphibians and reptiles, birds, mammals and aquatic organisms.

[25] I.e. microscopic plants and animals.
[26] I.e. animals that do not have a backbone.

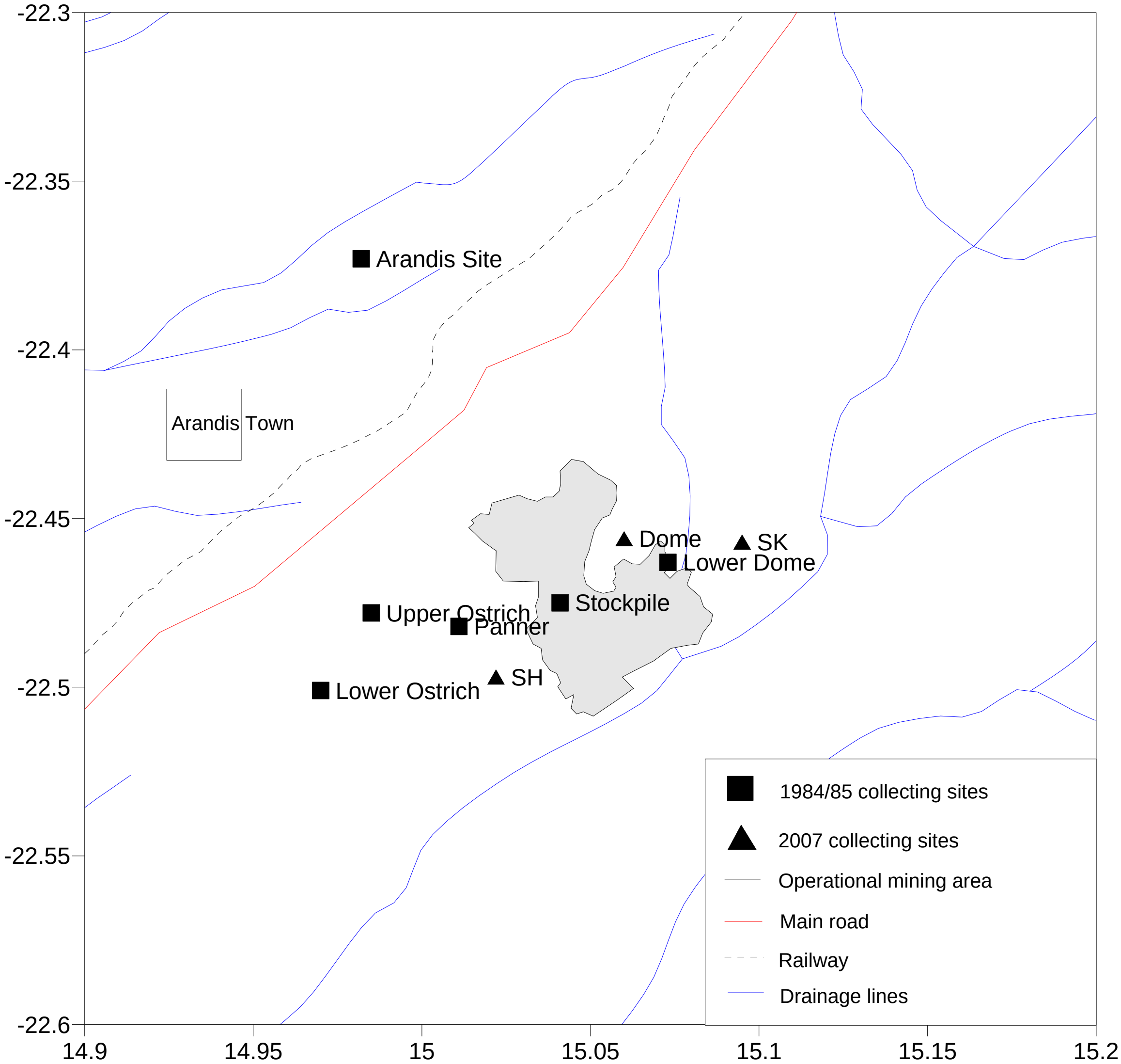

Figure 23: Location of animal biodiversity sampling sites during the 1984-1985 and 2007 fieldwork periods (source: EEAN)

The categorisation by the International Union for the Conservation of Nature (IUCN) in their Red List data is incomplete for Namibia, particularly in relation to invertebrates. Thus, using the IUCN criteria, the vulnerability and endemicity of the fauna known to occur in the study area had to be newly determined. In summary of this classification, an overall priority was compiled, as reflected in Table 7.

As far as habitat preference is concerned, the open plains support half of the high priority faunal taxa occurring in the study area, while rocky hillsides and watercourses each make up about a quarter. Open plains habitat extends beyond the Rössing area and is thought to contain fewer species that have restricted areas in which they occur. Watercourse habitat is similarly considered to be relatively widespread, given its linear character. Rocky hillsides, however, present relatively confined habitat.

The biotope mapping used the presence of selected plant indicator species to rank the biotopes as critical, rare or general. Of the 19 biotopes examined, five were regarded as critical, four as rare and ten as general. Of importance is that the five critical biotopes are all found in the rocky hillside habitats which the faunal habitat delineation had identified as deserving of the greatest protection.

Vulnerability	CR	EN	VU	Total
Endemicity				
Endemic to Rössing area	Critical[27] 8	Critical 9	Critical 1	18
Endemic to Central Namib	Critical 0	Essential 9	Major 7	16
Endemic to Central Western Namibia	Essential 0	Major 3	Medium 4	7
Endemic to Namib Desert within Namibia	Major 0	Medium 1	Significant 1	2
Endemic to geopolitical Namibia	Medium 0	Significant 0	Minor 0	0
Widespread	0	1	3	4
Total	8	23	16	47

Table 7: Numbers of threatened taxa and their levels of endemicity (source: EEAN)
CR = Critically Endangered; EN = Endangered; VU = Vulnerable

It should be noted that concern about the taxonomic status of an enigmatic bird species, the Karoo eremomela, has proved to be unfounded. Ornithologists Mark Boorman and Marc Durr undertook a mist-net capture exercise during December 2007 and confirmed the bird to be *Eremomela gregalis* subspecies *damarensis* (R Schneeweiss, pers. comm.).

As far as archaeology is concerned, a survey was undertaken during 2006 for the entire RUL mine licence area, and again during 2007 when the proposed mining of the SK area received attention. Three archaeological sites were identified in the latter study, namely the remains of a honey collecting scaffold, an area where several quartz fragments showing signs of their use as tools were found, and the remains of a structure likely to have been used as a hunting blind. The 2007 study resulted in the issuing of permits for the exploration phase of the SK project. With the exploitation of the SK4 ore body in particular now being considered, the impacts on these archaeological sites must again be evaluated, even though they occur outside of the SK4 area. The renewal and amendment of the permits for the entire SK area is being undertaken as part of the SEIA process and the necessary application to the National Heritage Council is underway.

b) Discussion

IMPACT ON ENDEMIC ANIMAL SPECIES

With reference to the faunal taxonomic groups examined in the study, it was found that:

- biological soil crusts occur in a reduced form compared to other desert habitats;

[27] By combining the criteria of IUCN status and the degree of endemism of taxa, priority classifications of critical, essential, major, medium etc. are achieved.

- that the abundance and diversity of spiders and other non-insect invertebrates appear lower than expected;
- that 20 of the 271 recorded species of ground-dwelling insect are threatened;
- that two reptile species are threatened; and
- that no bird or mammal species are of such conservation status that they require particular attention.

In summary, of the 44 high priority taxa identified, 18 are regarded as critical, i.e. those recorded as critical, essential, major, medium and significant in Table 7. However, rocky hillside habitat typical of the SK4 mining site supports seven of these species that are regarded as critical, namely three spiders, two sun spiders and two beetles. It is recognised that none of these are likely to be key species that many other organisms are dependent on, notwithstanding that their full life histories, and thus their role in the ecosystem, are not comprehensively understood. Although the biodiversity of the Rössing mine area has been better researched than similar areas of the Central Namib, it has been geographically focussed. A complete understanding of the broader conservation status of the species concerned is thus lacking.

The impact on endemic and possibly threatened animal species must be regarded as regional, since there could be cumulative implications throughout the range of the species concerned. It would be of long term duration, notwithstanding that the impact itself would occur over a short time period. The magnitude of the impact is regarded as medium, since a notable alteration in ecosystem functioning can be expected. The impact is thus believed to be of a high negative significance.

Mitigation measures
While direct mitigation is not possible, the present lack of knowledge upon which to base the assessment means that high levels of uncertainty exist. If the very limited spatial extent of possible habitat destruction is considered, i.e. SK4 comprising only 1 % of rocky hillside habitat within the RU mining licence area, an improvement in the level of understanding of the life histories of the species concerned may very well reduce the significance of the impact. Continued research into the abundance and distribution of the seven species identified as of critical conservation importance in the rocky hillside habitat would allow the level of confidence in this assessment to be improved. An intention of such continued research would be to ensure that as little information as possible is lost to science, if the habitat of certain animal species was to be destroyed. If this improved level of confidence shows the magnitude of the impact to result in a slight alteration to natural functions and processes, it may be regarded as low. A significance rating of medium negative may then be assumed.

Impact on endemic animal species		
	No mitigation	**Mitigation**
Extent	Regional	Regional
Magnitude	Medium	Low
Duration	Long term	Long term

SIGNIFICANCE	**High (-)**	**Medium (-)**
Probability	Unknown (lack of information)	Probable
Confidence	Unsure	Sure
Reversibility	Irreversible	Irreversible

IMPACT ON VEGETATION

With reference to the plant-based biotopes examined in the study, as an indication of biodiversity importance, it was found that a newly described biotope, defined by the undulating hills in the eastern, central part of the mining licence area, is of critical biodiversity value. The species of particular botanical importance found in the area are *Adenia pechuelii* (elephant's foot), *Aizoanthemum galeniodes* and *Petalidium canescens*. This biotope will evidently be impacted on by the SK4 mining operations.

Given the critical biodiversity status of the eastern hills biotope, the impact is regarded as regional, since there could be cumulative implications throughout the range of the species concerned. It would be of long term duration, notwithstanding that the impact itself would occur over a short time period. The magnitude of the impact is regarded as high, since a severe alteration in natural processes can be expected. The impact is thus believed to be of a highly negative significance.

Mitigation measures

Mitigation measures that have been recommended include reducing the footprint of mining activities as far as possible, rescue and replanting of the large *Adenia pechuelii* plants to an area that will not be disturbed in the future, testing the viability of rehabilitation and replanting, and improving the level of understanding of the plantlife in the area by continued collection. As indicated earlier in reference to animal species, an intention of such continued collection would be to ensure that as little information as possible is lost to science, if the habitat of certain plant species was to be destroyed. By applying these measures, the significance of this impact may well be reduced.

Impact on conservation-worthy plant species		
	No mitigation	**Mitigation**
Extent	Regional	Regional
Magnitude	High	Low
Duration	Long term	Long term
SIGNIFICANCE	**High (-)**	**Medium (-)**
Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible

IMPACT ON ARCHAEOLOGY

The three archaeological sites described in the archaeological assessment occur outside of the area of the proposed SK4 and will therefore not be directly affected. The findings of the archaeological assessment were that the occurrence of these sites is of low density, probably related to the rugged terrain and lack of water. Their possible disturbance is acceptable, since they have been comprehensively documented and are of very low archaeological value. The extent of the impact is regarded as local, due to the limited area under consideration, although the impact would be long term. The magnitude of the impact is believed to be low, given the slight alteration to social processes. A low negative impact significance would thus result.

Mitigation measures

Mitigation measures in the form of the comprehensive documentation of the archaeological sites in question has further reduced the magnitude of the impact and its significance after mitigation is regarded as a very low negative impact.

Impact on archaeological sites		
	No mitigation	**Mitigation**
Extent	Local	Local
Magnitude	Low	Very low
Duration	Long term	Long term
SIGNIFICANCE	**Low (-)**	**Very low (-)**
Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible

IMPACT OF DUST ACCUMULATION

Regarding the indications that biological soil crust activity is reduced and that spider and sun spider populations are lower than expected, these may be due to habitat deterioration from dust accumulation. Although the accumulation of dust is certain, the present level of understanding of the implications of the phenomenon means that further work would be required before reliable predictions of its impact can be made.

This impact is regarded as regional, since there could be cumulative implications throughout the range of the species concerned. It would be of long term duration, notwithstanding that the impact itself would occur over the three year period projected for mining the SK4 ore body. The magnitude of the impact is regarded as medium to low, since a slight or notable alteration in ecosystem functioning can be expected. The impact is thus believed to be of a medium negative significance.

Mitigation measures

As indicated previously, direct mitigation is not possible and the present lack of knowledge upon which to base the assessment means that high levels of uncertainty exist. However, if the very limited spatial extent of the possible dust source is considered, i.e. SK4 comprising only an additional 1.8 ha of exposed substrate compared to the current spatial extent of the tailings dam and waste rock disposal areas that together comprise approximately 1 300 ha, it would be difficult to specify additional mitigation measures other than those already in place. Improvement in the level of understanding of the implications of dust accumulation on ecological functioning may very well reduce the significance of the impact and the matter will receive detailed attention during the Phase 2 SEIA process, when considerably larger areas of exposure will need to be considered.

Impact of dust accumulation		
	No mitigation	**Mitigation**
Extent	Regional	Local
Magnitude	Medium - low	Low – very low
Duration	Long term	Long term
SIGNIFICANCE	**Medium (-)**	**Low (-)**
Probability	Unknown (lack of knowledge)	Unknown (lack of knowledge)
Confidence	Unsure	Unsure
Reversibility	Irreversible	Irreversible

5.6 CONTRUCTION PHASE IMPACTS

5.6.1 Generic construction phase impacts

a) Impact Statement

There are impacts on the socio-economic and biophysical environment that would occur during the construction phases of the proposed acid plant and ore sorter that are not exclusive to the particular project. Such generic impacts are common to all construction sites and can usually be reliably predicted and mitigated. Typical construction phase impact management actions would include the following:

- Dust, noise and vibration control;
- Secure storage of fuel and hazardous materials;
- Proper maintenance and operation of equipment and machinery;
- Proper collection, storage and disposal of refuse;
- Provision of facilities for workers on site (lighting, toilets, water, eating areas etc.);
- Installation of emergency plans (fire, evacuation etc.) and first-aid procedures;
- Control of traffic safety and road conditions;
- Application of access control and security procedures;
- Application of statutory occupational health and safety standards throughout the site;
- Installation of contingency plans for spillage of fuels or hazardous substances;
- Demarcation of exclusion zones to limit biodiversity disturbance, heritage resource impacts and soil erosion; and
- Control of surface runoff and impacts on water resources.

The generic construction-related impact management actions listed above have been incorporated within the Social and Environmental Management Plan (SEMP) compiled as part of this Draft SEIA Report and presented in Annexure A. Together with the continued application of RU's own best practice and performance standards, particularly those relating to occupational health and safety, typical construction-related impacts can be confidently predicted to be well managed. By implication, any contractors tasked with construction activities will be obliged to maintain the same high standards.

b) Discussion

A composite assessment of the generic construction-related impacts would indicate that their extent would be local. Their magnitude would be low, since a slight alteration must result from any physical construction activity. A short term duration is in keeping with the limited period of time during which construction occurs. The significance of generic construction phase impacts is therefore regarded as negative but very low.

Mitigation measures

Additional mitigation measures are not considered, since best practice and appropriate environmental control measures are already being applied and RU is committed to compliance with all the statutory requirements that govern typical construction site impacts.

Generic construction phase impacts		
	No mitigation	**Mitigation**
Extent	Local	N/A
Magnitude	Low	N/A
Duration	Short term	N/A
SIGNIFICANCE	**Very low (-)**	N/A
Probability	Definite	N/A
Confidence	Certain	N/A
Reversibility	Reversible	N/A

Construction phase impacts related to the extension of the ore sorting plant and construction of the new acid plant are regarded as low, since few of them are site-specific. However, specialist studies have considered construction phase impacts in appropriate cases, namely the cross-cutting issues of employment creation and construction camps.

5.6.2 Impact on employment creation during construction

A full copy of the report titled *Socio-economic Component of the Social and Environmental Assessment Report for the Rössing Uranium Mine Expansion Project: Socio-economic Impact Assessment and Recommendations for a Socio-economic Management Plan* compiled by Marie Hoadley is included as Annexure C of this SEIA Report. It forms the basis of the findings presented in this section.

a) Impact Statement

Mining projects are generally labour-intensive during their construction phases, although this fact must be offset against the non-permanent nature of the employment. Initial estimates are that the acid plant would provide in the order of 150 to 200 construction jobs. Figures are not yet available for the ore sorter and the mining of SK4 would not require a "construction" phase *per se*, since the pioneering work to open the ore body would be undertaken by permanent or already contracted employees.

It should also be noted that the proportion of unskilled workers required during construction is higher than during the operational phase. A positive benefit of in-service skills enhancement is thus available. Although of a limited duration, construction phase employment will also contribute to the multiplier effect in the regional economy.

b) Discussion

The impact would be felt at all levels, i.e. local, regional and national, since not only would there be an increased cash inflow in neighbouring towns, remittances to labour-sending areas elsewhere in Namibia would also occur. The magnitude of the impact is regarded as medium since there would be a notable alteration in livelihood enhancement. The duration of the impact is regarded as short term, although the effects may be felt for several years. The probability of it occurring is definite and the impact would not occur if economic conditions should change unfavourably.

The significance of employment opportunities during the construction phase is therefore regarded as moderately positive, since the duration of the impact is limited.

Mitigation measures

There is the potential to further enhance the positive impact of construction phase employment, if contractors were to be required to undertake in-service job training. The potential of temporary workers finding permanent employment or being better equipped to find employment outside of RU would thus be enhanced. However, the low skills base and short term nature of construction employment would not significantly increase the already positive impact.

Impact on employment creation during construction		
	No mitigation	**Mitigation**
Extent	Local - National	Local - National
Magnitude	Medium	Medium
Duration	Short term	Short term
SIGNIFICANCE	**Medium (+)**	**Medium (+)**
Probability	Definite	Definite
Confidence	Certain	Sure
Reversibility	Reversible	Reversible

5.6.3 Impact of construction camps

A full copy of the report titled *Socio-economic Component of the Social and Environmental Assessment Report for the Rössing Uranium Mine Expansion Project: Socio-economic Impact Assessment* compiled by Marie Hoadley is contained in Annexure C of this Draft SEIA Report. Together with the *Statement of Alternatives*, it forms the basis of the findings presented in this section.

a) Impact Statement

As described previously, mining projects are generally labour-intensive during their construction phases. Initial estimates are that in the order of 150 to 200 construction jobs would be provided by the acid plant installation, while figures for the ore sorter are not yet available. The mining of SK4 would not require a "construction" phase *per se*, since the pioneering work to open the ore body would be undertaken by permanent or contracted employees.

The social impacts of construction camps result from large numbers of workers who, while separated from their families and not having the normal family-related duties and distractions, tend towards abusive behaviour. Such behaviour often involves alcohol, promiscuity and violence. With contract workers receiving a relatively high income, tensions may result in relation to lower earning local communities. The social cohesion of local communities may result, particularly when there is ignorance of local customs and practices.

Three alternatives[28] were examined in the socio-economic specialist study, namely housing the construction workers in Arandis in permanent free-standing houses that would be made available to permanent RU employees once the construction phase ends, negotiating the use of two farms identified for the purpose (one state and one private), and building housing in an area identified in Swakopmund.

Based on the recommendations made in the *Statement of Alternatives* provided as part of the socio-economic study, a simple tabulation is presented below that rates the indicators, i.e. those factors that can be compared against each other in such a way that a preference is apparent, of the three alternatives on a nominal scale of low, medium or high, and whether the impact would be positive or negative. Table 8 shows that, while the Arandis option has considerable benefits, it also has the disadvantage of entrenching social differentiation and posing post-construction challenges related to the town's economic dependence on RU. The option of private/state farms appears to be the most suitable in terms of avoiding social and economic disruption and increased use of the B2 between Rossing and the coastal towns. The option of housing construction workers in Swakopmund also has several advantages but these are offset against the need for transport to and from the construction sites on the mine. On balance, the private/state farms option appears to be optimal.

Alternatives → **Indicators ↓**	**Arandis**		**Private/state farms**		**Swakopmund**	
Proximity to the mine	High (+)		Low (+)		Low (-)	
Availability of services	High (+)		Low (-)		High (+)	
Traffic implications on B2	High (+)		Low (-)		Med (-)	
Social and communal life	Low (-)		Med (-)		Low (-)	
Economy of Arandis	High (+)		Med (+)		Low (-)	
Entrench social difference	Med (-)		Low (-)		Low (+)	
Post construction period	Med (-)		Low (-)		Med (+)	

[28] Note that four alternatives were initially examined in the Draft SEIA Report. The alternative of re-using a construction camp in the vicinity has been abandoned, due to a shortcoming in best labour practice that was not identified at the time.

Cumulative benefit	Low (+)		Low (-)		Med (+)	
Biophysical impacts	Low (-)		Med (-)		Low (-)	

Table 8: Rating of the four construction camp alternatives (low to high and positive or negative)

b) Discussion

The extent of the impact will be felt at the local level. Regarding the magnitude of the impact insofar as social conditions and functioning are concerned, Swakopmund, as a sizable, diverse and resilient community, could assimilate the new arrivals. Arandis, a small, non-cohesive community with few coping mechanisms, would be subjected to greater impact and the assessment table reflects this. The private/state farms option does not present a possibility for social impacts, as both sites are situated in areas remote from community groups. The private/state farms options are thus believed to be of low magnitude and the Swakopmund option as of medium magnitude. The duration of the impact would be short term in all cases.

Mitigation measures

<u>As some of the contractors will be local, and much of the unskilled labour required during construction will also be sourced locally and thus have accommodation, the mitigation measures proposed are intended to become operative in the event that a large part of the construction labour force comes from outside the area and will need accommodation.</u>

Mitigation in the form of comprehensive management plans for construction camps and locating such camps away from settled communities can go a long way towards reducing this impact. Comprehensive management plans should be a contractual requirement in any event.

Impact of construction camps				
	Arandis		**Private/state farms**	
	No mitigation	**No mitigation**	**No mitigation**	**Mitigation**
Extent	Local	Local	Local	Local
Magnitude	High	Low	Low	Low
Duration	Short term	Short term	Short term	Short term
SIGNIFICANCE	**Medium (-)**	**Very low (-)**	**Very low (-)**	**Very low (-)**
Probability	Probable	Probable	Probable	Probable
Confidence	Sure	Sure	Sure	Sure
Reversibility	Reversible	Reversible	Reversible	Reversible
	Swakopmund			
	No mitigation	**No mitigation**		
Extent	Local	Local		
Magnitude	Medium	Medium		
Duration	Short term	Short term		
SIGNIFICANCE	**Low (-)**	**Low (-)**		
Probability	Probable	Probable		
Confidence	Sure	Sure		
Reversibility	Reversible	Reversible		

All of the construction phase impacts described in this section would be managed through the implementation of a construction phase SEMP. The purpose of the SEMP would be to protect sensitive onsite and offsite features through controlling construction activities that could have a detrimental effect on the environment. A draft of the SEMP is contained in Annexure A of this report.

5.7 CUMULATIVE IMPACTS

As described in Section 4.3, cumulative impacts are difficult to deal with, since they may occur outside of the geographical area of the particular project being assessed and thus require the collaboration of other institutions, and involve broader social, economic and biophysical considerations outside the scope of project-level assessment. The fact that several other mining companies are currently pursuing uranium interests in the Erongo Region emphasizes the need for an holistic approach, by means of a strategic or sectoral level assessment. Such a forward-planning approach would require the collaboration of all the mining companies, under the guidance of relevant government departments, to bring about a common understanding of the entire array of cumulative, secondary and tertiary environmental impacts resulting from mining activities in the region. The Chamber of Mines of Namibia could play a leading role in such an initiative.

As far as the SEIA process for RU's Phase 1 expansion projects is concerned, the following impacts that have emerged as having cumulative social and environmental implications have been considered, and recommendations have been formulated as far as is practicably possible. It should be noted that the lack of quantitative information relative to projected increases in some of the identified cumulative impacts, due to the engineering designs not having been finalised, means that this section is largely based on the qualitative information presently at hand.

5.7.1 The economic sustainability of Arandis

Although Arandis was established by RU, it has subsequently become an independent local authority. Nevertheless, its dependency on mining activities in the region, and on RU's continued direct and indirect economic support in particular, have cumulative implications. The period of time that mining activities in the area are planned to last must be considered in terms of the town's economic sustainability after the mines close. For its part, RU is already assisting the Rössing Foundation and the Arandis Town Council in pursuing means to facilitate economic diversification and the consequent sustainability of Arandis in the long term.

5.7.2 Employment creation

As a result of the current and planned mining activity in the Erongo Region, significant employment opportunities are being created. While this is a positive factor that has secondary and tertiary consequences as a result of the multiplier effect, it can be enhanced by means of on-going training and skills development. Support should thus be given to such training initiatives in the mining sector, with resultant benefits in terms of achieving economy of scale. RU's efforts in technical skills development in the fields of mining and engineering should continue.

5.7.3 Public health

Cumulative impacts from potential groundwater and air pollution that extend beyond the Rössing mine site may have consequences for public health. However, the specialist studies undertaken for the present SEIA process have shown that these impacts are of an acceptably low significance, particularly given the mitigation measures recommended or already in place, and their on-going management and monitoring. Long term monitoring of these factors should be undertaken by all of the mining companies active in the area, and the results of such monitoring should be collated and critically evaluated in a collaborative fashion.

5.7.4 Permanent housing

The need for additional housing for employees of all of the mining companies active in the region has consequential effects on spatial planning, service availability and house prices. In particular, demand for housing on the part of all the mining companies could destabilise the market in the short to medium term. With reference to Section 5.2.5, RU intends providing housing for its employees preferably in Swakopmund and/or Walvis Bay. To address the cumulative impact of housing, such housing projects should be designed in such a way that they would be suitable for occupants other than mine employees after the mines close.

5.7.5 Local economies

The cumulative socio-economic situation should generally improve as a result of the current and future activities of all of the mining companies in the Erongo Region, since the additional requirement for goods and services will stimulate the secondary and tertiary commercial sectors. To further enhance this positive impact, RU should continue its policy of local procurement, particularly by supporting the building of capacity amongst local service providers, seeking opportunities for the participation of women in the local economy, and prioritising diversification and development that will reduce dependence on mining-related activities.

5.7.6 Inward migration

The stimulation of the economy and possibility of employment opportunities that will result from the current and future activities of all the mining companies in the Erongo Region will attract people from economically less well endowed parts of Namibia. This has the unfortunate consequence of increasing local unemployment rates, densification of already inadequate housing and informal settlements, and related increases in poverty, ill-health and social ills. There is also very little in the way of management intervention that can be done to stem inward migration. However, RU can assist in reducing the cumulative nature of the impact by promoting home ownership in formal housing, thereby reducing backyard shack dwelling and informal housing.

5.7.7 Schooling

The need for additional schooling facilities is a cumulative consequence of the current and future activities of all the mining companies in the Erongo Region. As indicated in Section 5.2.8, it is recommended that RU collaborates with other uranium mines and the Ministry of Education to build additional schools in the areas where the workforce will reside.

5.7.8 Regional infrastructure

Increased demands on the supply and reticulation of water and the provision of electricity and transportation facilities are consequences of the cumulative need for such services for all the mining companies in the region. The additional supply of water in bulk to RU and other users is due to be provided by means of a desalination plant commissioned by NamWater. As far as electricity is concerned, the present high demand being experienced regionally will be somewhat ameliorated by RU reducing their needs as a consequence of utilising additional electricity generated by their proposed acid plant, as described in Section 2.1.1. Regarding transportation facilities as they affect RU, the Phase 1 components of their expansion project should be accommodated by the present road capacity. However, the longer term implications for the entire expansion project, i.e. including Phase 2, may require a broader study that addresses the cumulative impact on transportation in the context of increased traffic volumes regionally. The issue of traffic safety should receive particular attention.

5.7.9 Energy

This section addresses the cumulative use of energy by RU and in this sense is a local impact. There are presently no means of relating RU's energy use to a regional measurement. The energy use of each of the three components of RU's Phase 1 expansion project were investigated and a relevant specialist report compiled, as indicated in Sections 5.3.6, 5.4.7 and 5.5.7. When the figures for all three components are combined, GHG emissions for Phase1 would appear to increase by 4 % and energy use by 13 % compared to the 2006 situation. However, these figures are derived from the proportion of GHG emission and energy use per tonne of uranium oxide produced. A greater proportion of GHG emission and energy use occurs during pioneering work, since the material being moved is overburden that is not processed for uranium oxide extraction. A smaller proportion of GHG emission and energy use results from situations when high grade ore is being provided to the processing plant. The targets set by RU to reduce GHG emissions and energy use will continue to be pursued, notwithstanding the current difficulties in achieving these targets.

5.7.10 Dust

The air quality specialist study has shown that dust emissions, particularly from the haulage of ore from the proposed SK4 pit, could have impacts that approach the adopted limits of dust concentration at the boundary of the mine. This impact would be reduced to acceptable levels by implementing the suggested mitigation measures of wet or chemical suppression. Nevertheless, when considering dust emitted by the activities of all the mines in the region, their cumulative impact should be monitored and exceedances and anomalies identified and responded to. RU is collaborating with the Chamber of Mines of Namibia in sector-wide working groups looking *inter alia* at human health implications of uranium mining and these should provide the necessary mechanisms to attend to dust as a cumulative impact.

5.7.11 Groundwater

Cumulative effects on groundwater quality and quantity may result from abstraction from and contamination of the Khan River aquifer. The amount abstracted from the Khan River is carefully monitored and RU's use of this source is set at a limit at which no further abstraction will occur. The quality of groundwater is monitored by means of testing water samples from a network of boreholes throughout the mine licence area and in the Khan and Swakop rivers. The management of seepage and contaminated groundwater flow by means of cut-off trenches allows for its collection and safe disposal. The assessment shows that the cumulative impact on groundwater from the proposed Phase 1 developments is thus not significant.

5.7.12 Biodiversity

With reference to the impacts on biodiversity that may result from the mining activities in the Erongo Region, the cumulative nature of the habitat destruction that will result must be considered. However, with reference to RU's proposed Phase 1 developments, the relevant specialist study acknowledges that a high level of uncertainty exists due to the present lack of knowledge of the extent of the range of affected animal species. As far as plants are concerned, a degree of mitigation is possible in the form of rescuing and replanting species of conservation value. To address the cumulative impacts on biodiversity, it is necessary to promote research into the life histories and range of animal species occurring in the entire region affected by all the current and proposed mining activities. RU is pursuing such research within its own mining licence area.

5.7.13 Waste

Various forms of waste are generated on the Rössing mine and these will continue to be managed or, in some cases, will need enhanced management. Domestic waste will continue to be disposed off as landfill in the designated waste rock dump and although an increase in volume of such waste can be expected with the expanded activities on the mine, the space available for its disposal is not limited. Similarly, hazardous waste will continue to be disposed of under controlled conditions in the designated site within the tailings dam. Certain materials such as used hydrocarbons, spent catalyst and scrap metal are removed from the mine site by the suppliers or contractors employed for the purpose and this practice will continue. The existing waste water treatment plant on the mine is capable of dealing with the projected increased volumes since it was originally designed for and served a staff complement of 3 600. Construction waste will be managed according to prescriptions that are contained in the SEMP. The most critical issues as far as waste generated by RU's expansion project are concerned are the increase in waste rock and tailings from the mining and processing activities respectively. Phase 2 of the SEIA process will have a major focus on these issues and will allow for a more comprehensive assessment of their cumulative impacts. For the present Phase 1 SEIA process, however, the means of managing increased volumes of waste is regarded as acceptable.

6 CONCLUSIONS AND RECOMMENDATIONS

This chapter concludes the report, describes the recommendations that have emerged from the assessment of identified potential impacts and mitigation measures, and provides a synopsis of the preferred alternative actions that RU is applying for authorisation of.

6.1 CONCLUSIONS

The proposed developments consist of RU establishing the following components of their Phase 1 expansion project:

Acid plant:

- A sulphuric acid production plant to be built at the Rössing mine site;
- The existing on-site acid storage facilities to be upgraded and utilised to store the acid produced;
- Rail transport by TransNamib through Walvis Bay and Swakopmund of elemental sulphur feedstock for the acid plant; and
- The offloading, storage and handling facilities at Rössing mine to be installed or upgraded.

Ore sorter plant:

- The system for ore reclaiming from the coarse ore stockpile;
- A pre-screening plant;
- The production ore sorting plant, comprising four screening units and two ore sorter clusters;
- The handling of rejected rock;
- Storage and transport of rejected rock to the nominated waste disposal area; and
- The tie-in for all equipment into the current operation.

Mining of SK4:

- Providing access to the ore body;
- The provision of water for drilling and dust suppression;
- The commissioning work to prepare for production mining, i.e. the creation of drilling platforms and excavation of two 15 m benches;
- Drilling, blasting, loading and haulage of ore;
- The transport of waste material to the *Waste 7* site; and
- A haulage road to transport the ore to the primary ore crusher.

We submit that this Draft SEIA Report provides a sufficiently comprehensive assessment of the environmental issues raised during the Scoping Stage by I&APs, stakeholders, National, Regional and Local authorities, RU and the SEIA project team. Table 9 provides a summary of the significance of the environmental impacts associated with this proposed project.

OPERATIONAL PHASE						
Socio-economic impacts			**No mitigation**		**Mitigation**	
	Sustainability of Arandis		High (-)		Med (+)	
	Permanent employment creation		Med (+)		High (+)	
	Public health & safety		Med (-)		N/A	-----
	Housing & accommodation					
		Arandis	Med (-)		N/A	-----
		Swakop/Walvis	Low (-)		N/A	-----
	Local economies		Med (+)		N/A	-----
	Inward migration		High (-)		N/A	-----
	Schooling		Med (-)		Low (-)	
	Infrastructure					
		Electricity supply	Low (-)		Low (-)	
		Transportation	Med (-)		Med (-)	
Impacts of acid plant & associated storage & transport						
	Air quality		Low (-)		V low (-)	
	Human health					
		Risk assessment	Low (-)		N/A	-----
		Bacteria in cooling water	Med (-)		V low (-)	
		Long term occupational health	Low (-)		N/A	-----
	Visual impact		Low (-)		N/A	-----
	Water resorces		Low (-)		N/A	-----
	Noise & vibration		Med (-)		Low (-)	
	Energy use		Low (+)		N/A	-----
Impacts of ore sorter plant & associated rock disposal						
	Air quality		Med (-)		Low (-)	
	Human health		Low (-)		N/A	-----
	Visual impact		Low (-)		N/A	-----
	Water resources		Low (-)		V low (-)	
	Noise & vibration		High (-)		Low (-)	
	Reject rock disposal					
		Grit blasting yard valley	Med (-)		N/A	-----
		Existing waste dumps	Low (-)		N/A	-----
	Energy use		Med (-)		N/A	-----
Impacts of mining SK4 ore body						
	Air quality		Med (-)		Low (-)	
	Human health		Low (-)		N/A	-----
	Visual impact		Low (-)		N/A	-----
	Water resources		Med (-)		Low (-)	
	Noise & vibration		Med (-)		Low (-)	
	Waste rock disposal		Low (-)		N/A	-----
	Energy use		Med (-)		N/A	-----
	Biodiversity & archaeology of SK4					
		Impact on endemic animal species	High (-)		Med (-)	
		Impact on vegetation	High (-)		Med (-)	
		Impact on archaeology	Low (-)		V low (-)	
		Impact of dust accumulation	Med (-)		Low (-)	
CONSTRUCTION PHASE						
	Generic impacts		V low (-)		N/A	-----
	Employment creation		Med (+)		Med (+)	
	Construction camps					
		Arandis	Med (-)		V low (-)	
		Private/state farms	V low (-)		V low (-)	
		Swakopmund	Low (-)		V low (-)	

High (-)		High (+)		**KEY**
Med (-)		Med (+)		
Low (-)		Low (+)		
V low (-)				

Table 9: Summary table of impact significance

6.1.1 Level of confidence in assessment

With reference to the information available at this stage of the project planning cycle, the confidence in the environmental assessment undertaken is regarded as acceptable for decision making.

It is acknowledged that the project details may evolve during the detailed design and construction phases. However, these are unlikely to change the overall environmental acceptability of the proposed project. Furthermore, any significant deviation from that assessed in this SEIA should be subject to further assessment and may require an amendment to the conditions of the MET:DEA clearance, after due process has been met.

As mentioned in Section 1.5, independent review of the draft version of this SEIA Report has been undertaken, by both internal and external review consultants. These comprised internal reviews by Dr Peter Ashton of the CSIR in South Africa, a recognised expert with particular knowledge of the Rössing site and operations, and Dr Geoff Ricks, a Principal Environmental Advisor with Rio Tinto's T&I group in the United Kingdom. External review has been undertaken by the Southern African Institute for Environmental Assessment. Copies of these review reports are included as Annexure N of this report.

The independent reviews did not find fundamental shortcomings in the Draft SEIA Report. However, considerable amendment to the report in response to the reviews has been undertaken, as far as it was deemed necessary. On balance, the independent reviews have confirmed our belief that this finalised SEIA Report for Phase 1 of RU's expansion project provides an acceptably comprehensive and reliable body of information to allow decision making to occur with confidence.

6.1.2 Operational phase impacts on the social and biophysical environment

Table 8 shows the impacts of the operation of the proposed Phase 1 expansion project components on the social and biophysical environment. The most significant negative impacts, i.e. those of a ***medium or high negative rating, without mitigation*** include the following:

Socio-economic:

- Impact on the sustainability of Arandis~
  Continued investment in infrastructure by RU will perpetuate the town's economic dependence, with possible consequences when mining ceases.
- Impact on public health and safety~
  Off-site public health and safety impacts could potentially be derived from downstream groundwater contamination and windborne dust and air pollution, as well as the transport of goods, materials and product to and from the mine.
- Impact of housing and accommodation in Arandis~

The impact would be higher in Arandis because of the less diversified economy and more limited housing stock, when compared to the alternative of using Swakopmund and Walvis Bay for the purpose.

- Impact of inward migration~

  A high impact may be expected from an increase in local unemployment rates, densification of already inadequate housing and informal settlements, and related increases in poverty, ill-health and social ills.

- Impact on schooling for RU employees~

  There is a disparity between the ease of access to schooling on the part of the economically secure sector of the population, and the larger sector that finds such access difficult.

Acid plant:

- Impact of bacteria in cooling water~

  The bacterium *Legionella pneumophila* that causes Legionnaire's disease occurs in cooling systems such as used in the proposed acid plant.

- Impact of noise and vibration~

  A significant increase over ambient noise levels may be expected as a result of the operation of the proposed acid plant.

Ore sorter:

- Impact on air quality~

  The installation of the proposed ore sorter plant and disposal of reject rock would result in fugitive dust emissions that may impact on workers on the site and on residential areas further afield.

- Impact of noise and vibration~

  Noise derived from the ore sorter plant will be the dominant continuous noise source on the mine.

- Impact of using the grit blasting yard valley for reject rock disposal~

  Using this area for reject rock disposal would have a greater impact than the alternative of using existing rock waste disposal sites.

- Impact of energy use~

  An increase over the 2006 values for GHG emissions and energy use is projected as a result of operating the ore sorter.

Mining SK4:

- Impact on air quality~

  The haulage of ore to the primary crusher would result in dust emissions and the blasting would release CO and H_2S that may impact on workers on the site and on residential areas further afield.

- Impact on water resources~

  Water would be required for dust suppression and the amount of industrial-quality water available for this purpose is limited.

- Impact of noise and vibration~

  Continuous noise from drilling, loading and haulage activities, and the transient noise from blasting, would impact for a considerable distance, particularly at night.

- Impact of energy use~
  An increase over the 2006 values for GHG emissions and energy use is projected as a result of mining the SK4 ore body.
- Impact on endemic animal species~
  Seven species regarded as having critical conservation value may be affected by the proposed mining of SK4.
- Impact on vegetation~
  A biotope that occurs in the SK4 area is regarded as of critical biodiversity value.
- Impact of dust accumulation~
- There are indications that biological soil crust activity is reduced as a result of the accumulation of dust derived from mining activities.

6.1.3 Construction phase impacts

Table 8 shows the impacts of the construction of the proposed Phase 1 expansion project components on the social and biophysical environment. The most significant negative impact, i.e. with a ***medium negative rating, without mitigation*** was the following:

- Impact of a construction camp on Arandis~
  As a small, non-cohesive community with few coping mechanisms, Arandis would be subjected to a greater impact of anti-social behaviour related to the temporary housing of a large number of workers.

6.1.4 Social and Environmental Management Plan

A draft of the SEMP that has been developed to guide the construction and operational phases of the proposed project is contained in Annexure A of this report. The implementation of the SEMP would minimise possible negative impacts on construction and operation and assign responsibility for environmental controls, i.e. ensure that the recommended mitigation measures are applied and the impact significance ratings are consequently reduced to acceptable levels. More detailed project specifications, for inclusion in the various construction contracts, would be required should the project be approved and the engineering designs of the various components have been finalised. The detailed project specification would also take cognisance of any conditions of the MET:DEA clearance.

<u>It should be noted that the Draft SEMP presented in Annexure A is designed to serve as a clear and detailed indication of RU's intention to address environmental controls during the construction, operation and decommissioning stages of the Phase 1 expansion project. Its finalisation and ultimate approval is expected to be a condition of the environmental clearance presently being sought from MET:DEA.</u>

6.2 RECOMMENDATIONS

6.2.1 Alternatives

With reference to the alternatives examined in this SEIA process, and described in Chapter 5 and Table 8, the following are recommended as preferable:

- Reject rock disposal:

  The most suitable means of dealing with reject rock from the ore sorter plant is believed to be to use existing waste disposal sites in the short to medium term. A long term solution should be sought when the spatial requirements for tailings, waste rock and heap leaching are investigated in Phase 2 of the SEIA.

- Housing additional RU employees:

  The preferred alternative recommended for housing for additional RU employees is that it should occur in Swakopmund and/or Walvis Bay.

- Housing construction workers:

  The housing of construction workers on private or state-owned farms in the vicinity is recommended as the preferable alternative.

- Schooling for RU employees:

  Lobbying the government to build new schools is believed to be the preferred option since it is the most sustainable and responsibilities can be clearly defined.

6.2.2 Mitigation measures

For numerous of the impacts identified in the process and examined in Chapter 5, the key to the most effective mitigation measures available lies in the application of international best practice, either in the engineering design of the particular project component, or through the strict on-site implementation of existing operational controls to ensure that prescribed performance standards or limits are met. In these cases there is no need for specification of additional mitigation measures, since the objective of mitigation has effectively been addressed and any additional mitigation is unlikely to further reduce the significance of the impacts. The advantages in dealing with this category of impacts are that the design engineers and operational staff have given due consideration to the relevant social and environmental issues and have built in the required mitigation measures (hence no need to specify any in addition), and that strict implementation is guaranteed.

However, the significance levels of most of the rest of the identified impacts could generally be reduced by implementing the recommended mitigation measures. This section summarises the recommended mitigation measures described in Chapter 5, where these are available, and the assumption is made that these will be implemented.

a) Socio-economic

- Impact on the sustainability of Arandis~
  Pursue means of economic diversification, to contribute to sustainability.
  Continue assistance for capacity building in the Town Council of Arandis.
- Impact of inward migration~
  No substantial mitigation of this impact is thus foreseen, although RU would strive for their workforce to live in socially stable conditions.
- Impact on schooling for RU employees~
  Purposeful and collaborative action to get schools built, in conjunction with government.

b) Acid plant

- Impact of bacteria in cooling water~
  Minimise water stagnation and process leaks, maintain system cleanliness by disinfection, use scale and corrosion inhibitors, and efficient mist eliminators on cooling towers.
- Impact of noise and vibration~
  Strictly apply adopted standards and equipment maintenance.

c) Ore sorter

- Impact of air quality~
  Hardening and better binding of road surfaces and restricting traffic volumes and speed.
- Impact of noise and vibration~
  Design acoustic damping and acoustic enclosures into the plant, and apply adopted standards and procedures.

d) Mining SK4

- Impact on air quality~
  Hardening and better binding of road surfaces and restricting traffic volumes and speed.
- Impact on water resources~
  Reduce the rate of evaporation from the tailings dam, install more efficient seals on the slurry pumps and use recycled water for dust control at the fine crushers and leach tanks (note that these are measures that would be applied elsewhere on the mine, to the benefit of SK4's water requirements).
- Impact of noise and vibration~
  Strictly apply adopted standards and procedures, as well as careful blast charge calculation, monitoring, early notification, correct stemming of blastholes and equipment maintenance.
- Impact of eradication of endemic animals~
  Improve the level of understanding of the life histories of the species concerned, i.e. continued research.
- Impact on vegetation~
  Reduce the footprint of mining activities as far as possible, rescue and replant the large *Adenia pechuelii* plants, test the viability of rehabilitation and replanting, and improve the level of understanding of the plantlife in the area by continued collection.
- Impact of dust accumulation~

Improve the level of understanding of the impact of dust on biological soil crust ecosystems, i.e. continued research.

e) Construction phase impacts

- Impact of a construction camp on Arandis~

  This impact would be avoided by the adoption of the preferred alternative, i.e. for RU to negotiate the use of construction camps on private or state-owned farms in the vicinity.

6.3 THE WAY FORWARD

A draft version of this SEIA Report was released for review and comment by I&APs, stakeholders, review consultants and authorities. With all the comments and concerns raised having been incorporated in this final SEIA Report, it will now be submitted to MET:DEA for their consideration.

In considering this final SEIA Report, MET:DEA will ascertain whether the process undertaken is acceptable and whether there is adequate information to allow for an informed decision. Should the above be acceptable, they will need to decide on the social and environmental acceptability of the proposed project. MET:DEA's decision will be documented by a clearance of the project that will detail the decision and describe any conditions they might impose. Following the issuing of the MET:DEA clearance, their decision will be communicated by means of a letter to all registered I&APs and stakeholders.

If a clearance is issued for the Phase 1 components assessed in the present SEIA process, RU will be able to move from the planning stage of the project into the construction stage.

As the environmental practitioners responsible for leading this SEIA process, Ninham Shand are of the opinion that the project components assessed and being applied for, namely the acid plant, ore sorter and mining of SK4, should be positively received by MET:DEA and that an environmental clearance should be issued. This opinion is based on our comprehensive understanding of the environmental impacts likely to result from the acid plant, ore sorter and mining of SK4, as detailed in this and preceding documentation, and that the alternatives and mitigation measures as described and recommended will reduce the identified environmental impacts to an acceptable level.

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1	Erongo Regional Council	Hard copy
1	Arandis Town Council	Hard copy
1	Swakopmund Town Council	Hard copy
1	Walvis Bay Town Council	Hard copy
1	Arandis Library	Hard copy
1	Swakopmund Library	Hard copy
1	Walvis Bay Library	Hard copy
1	Windhoek Library	Hard copy
1	Ninham Shand : George library	Hard copy / Electronic
2	Ninham Shand : Head office library	Hard copy
11	Specialists	Electronic
31 issued		