ANNEXURE B:
RÖSSING URANIUM HSE SUMMARY

Rössing Uranium Limited

Rio Tinto

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Overview of the Rössing Uranium Limited Health, Safety and Environment Management System

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Contents page

List of Figures

Acronyms

AIDS	Acquired Immune Deficiency Syndrome
Am-241	Americium-241 isotope in nuclear waste
Bq	Becquerel
Bq/cm^2	Becquerel per square centimetre
Bq/g	Becquerel per gram
Cs-137	Radioactive isotope of caesium
Cd-109	Cadmium
CBWUF	Coastal Bulk Water Users' Forum
dBL	Decibel
DW	Dewatering Wells
DWA	Department of Water Affairs
EMS	Environmental Management System
FeS_2	Pyrite
FLM	First Line Manager
GBq	Gigabecquerel
g/m^3	Grams per cubic metre
g/t	Grams per ton
HIV	Human Immunodeficiency Virus
HSE IPs	Health, Safety & Environmental Improvement Plans
HSE MS	Health, Safety & Environmental Management System
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ISO 14001	International Standards Organisation 14001
Lb	Pound
LLRD	Long-lived Radioactive Dust
m/month	Meters per month
mm/sec	Millimetres per second
m^3/day	Cubic meters per day
m^3/tonne	Cubic meters per tonne
mg/l	Milligram per litre
mg/m^3	Milligram per cubic metre
Mm^3	Million Cubic metre
Mm^3/a	Million Cubic metres per annum
MBq/g	Megabecquerel per gram
MAWRD	Ministry of Agriculture, Water & Rural Development
MS	Management System
MSDS	Material Safety Data Sheet
mSv	Milli Sieverts
mSv/a	Milli Sieverts per annum
mSv/h	Milli Sieverts per hour
MWh	Megawatts hour
NTSC	Northern Tailings Seepage Control
pH	Potential Hydrogen
PPE	Personal, Protective Equipment
ppm	Parts per million
SABS	South African Bureau of Standards
SEG	Similar Exposure Groups
SX	Solvent Extraction
TLD	Thermo-Luminescent Dosimeter
TDS	Total Dissolved Solids
U	Uranium
U_3O_8	Uranium oxide
US$	United States Dollar
µSv	Microsievert
V	Volt
WMP	Water Management Plan

INTRODUCTION

Rio Tinto's Rössing Uranium Limited (Rössing Uranium) has operated an open pit uranium mine in the Erongo Region of Namibia since 1976. The mine site is located about 70km north-east of Swakopmund, and encompasses a Mine Licence Area (MLA) of approximately 118km^2. Uranium oxide (U_3O_8) concentrate of a low radiation level is produced at the mine and transported via rail and sea for further processing to conversion and enrichment facilities in other parts of the world, where it is used as nuclear fuel in the power plants.

While Rössing Uranium makes a significant contribution to Namibia, both economically and socio-economically, the extraction of minerals from the earth is a process that has significant negative environmental consequences. This is in terms of physical disturbance, production of waste and use of natural resources. In 2010, a total of 3.0 million m^3 of water, 184,082MWh of electricity, and 18ha of land were used.

Mine activities thus need to be managed to ensure that the impact on both the biophysical and socio-economic environment are reduced to acceptable limits. This management is implemented in a number of ways, at all stages of mine operations, namely planning, construction, operation and decommissioning of facilities.

One form of management is the Health, Safety and Environmental Management System (HSE MS), an Environmental Management System (EMS) implemented by Rössing Uranium. An EMS is a systematic approach used by an organisation to ensure that health, safety and environmental considerations of all aspects of the operation are brought into decision-making and day-to-day operations. It not only helps to ensure that major health, safety and environmental risks and liabilities are identified and managed, it also establishes a framework for tracking, evaluating and communicating the performance in these aspects.

This summary aims to highlight the key points of the Rössing Uranium HSE MS in order to provide an adequate understanding of the system and the various management policies, programs and procedures already in use at the mine[1].

The brochure is set out as follows:

1. Overview of the mine operations and outline of environmental risks to be managed;

2. Overview of an EMS; and

3. Overview of the components of the Rössing Uranium EMS.

[1] This document can be attached to the various Environmental Impact Assessments (EIAs) and Environmental Management Programme (EMPs) currently underway, to provide the authorities and other stakeholders with a background to the existing systems in place at the mine.

MINE OPERATIONS AND ENVIRONMENTAL RISK

Mining is done by drilling, blasting, loading, and hauling from an open pit that measures 3km by 1.5km and is 390m deep. In 2010, 7.5 million tonnes of ore and 40 million tonnes of waste were mined and 3,638 tonnes of U_3O_8 produced by a sulphuric acid leaching process. This was achieved by the work of 1,592 permanent Rössing Uranium employees and an average of 1,800 contractors throughout the year. This high number of contractors is due to current expansion projects which include: removing of waste material around the pit so that ore can be exposed and preparation of the SK pit.

Figures 1 and 2 give an overview of the mining operations at Rössing Uranium, linked to the product and waste produced, as well as the location of mining components at Rössing. It also provides an indication of the significant negative environmental impacts at each stage. These impacts represent the risk of the operations to the environment. Risk management is therefore focused on mitigating the impact on the environment in terms of the following main areas of concern, throughout the mine and associated infrastructure and operations:

1. Radiation

External radiation caused by high energy beta particles and gamma rays. Exposure to radiation only occurs in close proximity to the source. Levels on the general mine site are very low and exposures to workers in mining and crushing are only slightly above the background levels received at home. Once the uranium has been recovered at the recovery areas, exposure levels do increase but are well within the international exposure standards. Internal exposure can potentially result from digestion or inhalation of radioactive particulates through one of the following means:

- Workers could ingest contaminated material while eating or smoking while fauna could eat contaminated vegetation. Dust deposited on plants may be absorbed by plants and eaten by animals. Digestion could also occur through the drinking of radioactively contaminated surface or ground water.
- Inhalation of dust generated on site, which contains very small amounts of radioactive material. The ore grade is 0.03% and monitoring has confirmed that this only contributes a small amount to the total dose of workers.
- Inhalation of radon and decay products of radon (referred to as “radon daughters”). Radon is a gas found throughout the air which is found in higher levels where uranium and thus radium, occurs such as the open pit at the mine, waste dumps, stockpiles, process plant areas and tailings dam. Radon daughters will settle on fine dust and any other particulates and can be inhaled.
- Monitoring has shown that no worker may be exposed to levels exceeding the annual standard dose for total radiation of 100mSv over a five year period (effectively 20mSv per year on average). The exposure to the public in Arandis area is below 1mSv per year.

2. Dust

The inhalation of dust from the mine poses a potential health risk mainly due to the presence of silica (quartz) in this dust, which has the potential of causing lung diseases, the most serious of which is silicosis. A standard of $0.5 mg/m^3$ is applied at the mine to control this exposure. Adherence to this standard is ensured through monitoring.

3. Emissions

Different gases and fumes are emitted through the processes and activities at the mine. The gas found throughout the mine is radon (dealt with above under radiation). As the mine uses either electricity or fuel, greenhouse gases are also emitted. Examples of other emissions are experienced in the environments close to the sources and will only impact those near the sources. These include:

- Mining - Exhaust fumes, blasting fumes and hydrocarbon fumes;
- Crushing - Exhaust fumes and hydrocarbon fumes;
- Leaching – Acid mist, sulphur dioxide, hydrogen sulphide (depending on the ore type leached), exhaust fumes and hydrocarbon fumes;
- Continuous Ion Exchange (CIX) - Hydrocarbon fumes; and
- Solvent Extraction (SX) – Hydrocarbon and solvent fumes.

4. Waste rock dumps

Impacts from waste dumps are those of safety, visual and the emission of dust and radon, as well as hydrocarbon fumes.

5. Tailings Dam

On the surface of the dam impacts are due to:

- Emission of dust and radon;
- Increase in footprint resulting in loss of flora and fauna;
- Soil erosion resulting in the spreading of contamination; and
- Process solution pools on the active deposition areas.

Impacts related to groundwater underneath the dam:

- Water contamination is of particular concern to neighbouring communities, owing to the scarcity of water resources in the region. Contamination could occur from seepage from the tailings storage site.
- The current water management system ensures that practically all process effluent is recycled, either directly from the tailings paddy pond or from the seepage dam and seepage control systems. Only a small volume of seepage reaches the underlying bedrock and dissipates into fractured bedrock whose permeability is too low for effective dewatering.

6. Chemical leaching from waste rock dumps

- Acid rock drainage (ARD) could form in mine waste rock dumps during operation or after closure if these contain pyrite. It results from the natural geochemical or biochemical oxidation of sulphides (e.g. pyrite) in disturbed, broken or milled rock. Pyrite (FeS_2) can only be oxidised to sulphuric acid if air and water are present. Results of environmental impact studies conducted showed that a small percentage of the waste rock were acid forming (namely the Pyritic Quartzite), but was mixed with other material that has a neutralisation capacity. Thus although there is a slight potential for acid rock drainage it is not considered a significant impact.
- Rain falling onto the dumps can infiltrate into the coarse material and reach the underlying alluvium. Flood water from the upper catchments flows through the lower part of the dumps and emerges at the downstream end either as surface or groundwater. Water percolating

through the waste rock could react with minerals and dissolve ions such as sulphate, nitrate or uranium. Nitrate in waste rock is derived from the explosive used at Rössing, which contains ammonium nitrate.

There are a number of processes that occur at the plant itself that can impact significantly on the environment, involving transport, storage and use of chemicals. The processes may also result in the production of waste, which are managed to reduce potential environmental risk. These processes are outlined in Figure 2. The management systems to deal with these risks are outlined in this document.

WHAT IS AN EMS?

RÖSSING URANIUM HSE MANAGEMENT SYSTEM

The HSE Management System (MS) implemented by Rössing Uranium is vital to ensure that management strategies related to health, safety and the environment are implemented and that the effectiveness of these strategies are monitored. The Rössing Uranium HSE MS is certified in terms of the ISO:14001 management system, which is a set of international standards for improving environmental performance of organisations. One of the key principles of this approach is that continual improvement in the organisation's environmental management can be achieved and demonstrated. Environmental management consists of a number of steps, undertaken in a methodical manner:

1. Planning – to identify risks and measures to manage these:
   - ✓ Determine goals;
   - ✓ Set up structures to achieve goals;
   - ✓ Plan activities to achieve goal; and
   - ✓ Assign resources and responsibilities to achieve goal;

2. Take action – to manage the risks :
   - ✓ Implement practices to achieve Rössing Uranium's HSE policy;

3. Monitor – to evaluate performance:
   - ✓ Check progress of actions against goals; and

4. Review – determine ways to improve:
   - ✓ Modify the system to reflect results of programme on a regular basis.

Effective management of issues of environmental concern is directly linked to the communication of, and reporting on environmental monitoring data and performance. This aspect is thus key to ensuring continual improvement in the HSE management system, which is an on-going, systematic and co-ordinated process. Figure 3 depicts the sequencing of the implementation of an EMS as well as the structure of a typical EMS.

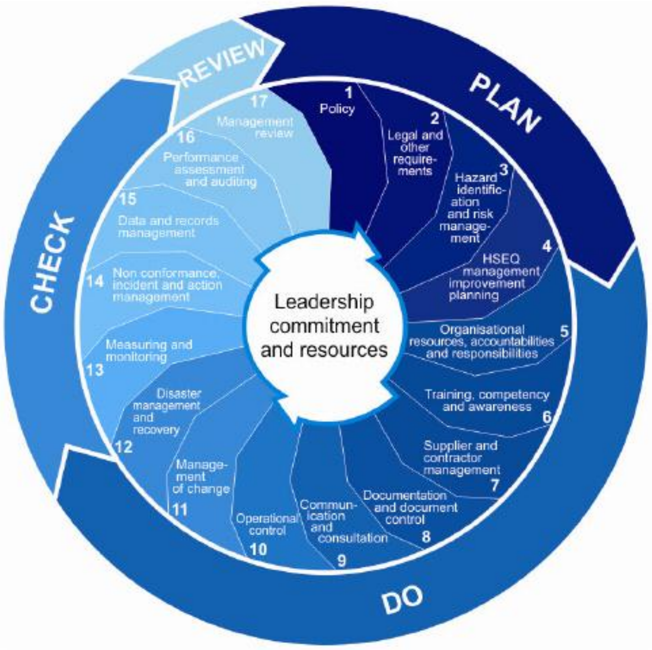

Figure 3: Sequencing and structure of an ISO 14001 EMS[2]

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[2] Source: Modified from NCEDR. 1998

OVERVIEW OF THE RÖSSING URANIUM EMS

Rössing Uranium has a Code of Practise to give effect to the HSE MS. This section gives a brief overview of the management practices and structures that enable the HSE MS.

PLANNING

RÖSSING URANIUM HSE POLICY

The system is based on an overarching HSE Policy, which guides the way the company does business and manages the impacts of its activities on the environment, the health and safety of its employees and on the public at large.

The following principles underpin Rössing Uranium's HSE Policy:

i. Protection of the health and safety of stakeholders; specifically employees, contractors, host communities, clients and shareholders is paramount;
ii. Operation of business with respect and care for both the local and global environment in order to prevent and mitigate residual pollution;
iii. Full compliance with all applicable legislation, standards and requirements;
iv. Continual improvement in HSE performance, and adoption of leading practice where applicable and feasible;
v. Provision of adequate training and resources to employees, contractors and visitors;
vi. Identification and assessment of hazards arising from activities and management of associated risks to the lowest practical level;
vii. Enhancement of biodiversity protection by assessing and considering ecological values and land-use aspects in investment, operational and closure activities;
viii. Raised awareness of HSE issues in our host communities;
ix. Regular review of performance, with public reporting on progress; and
x. Communication of Rössing Uranium's commitment to the HSE Policy to all our stakeholders.

The HSE MS applies to all areas under the responsibility of the Managing Director at Rössing Uranium. These areas include the Rössing mine site as well as relevant areas in the towns of Swakopmund (the town offices), Windhoek and Walvis Bay (acid off-loading and storage). The activities, products and services of the contractors on site are also subject to the HSE MS.

LEGAL REGISTER

The management of all identified HSE hazards / aspects complies with the relevant Namibian legal requirements[3] and relevant standards and guidelines to ensure that good international practices are applied to HSE management. A Legal Register to cover the following activities was produced and is updated periodically:

i. Mining of uranium;
ii. Waste disposal and pollution prevention;
iii. Transporting of radioactive and radioactively contaminated material;
iv. Water use and abstraction;
v. Occupational and public exposure;
vi. Occupational hazards and; and
vii. Worker health and safety.

[3] In the case where Namibian legislation is not available, relevant South African legal requirements and International standards are referred to in this legal register.

REGISTER OF HSE HAZARDS / ASPECTS

The policy and goals of the HSE MS are based on an understanding of all the HSE hazards / aspects of operations, products or services related to Rössing Uranium. This means that every hazard / aspect in which operations may affect health, safety and the environment are investigated so that the most important HSE impacts[4] (HSE hazards / aspects with significant impact) are identified.

An environmental impact is defined as any change to the environment, whether adverse or beneficial, which can result wholly or partially from an organisation's activities, products or services. A health impact is any activity, condition, service or change in the environment which can have a negative effect on an individual's health. A safety impact is defined as any activity, condition, service or change in the work environment which can have a negative effect on an individual's personal safety.

A description of the potential or known HSE impact as a result of each identified HSE hazard / aspect is listed on the HSE risk register. Where mitigating measures are already in place to reduce the severity of any potential impact to the health, safety and environment, these measures are also described. The potential impact resulting from each identified HSE hazard / aspect is then categorised into a HSE impact, according to Rio Tinto risk methodology, and updated annually by the HSE specialists, as follows:

- Critical priority impact, exceeding the risk acceptance threshold and requiring urgent and immediate action.
- High priority impact, exceeding the risk acceptance threshold and requiring proactive managements. Active monitoring of implemented management actions is required.
- Moderate priority impact, where risk falls just within/on the risk acceptance threshold. Management may be implemented to further reduce risk and active monitoring is required.
- Low priority impact, where risk falls below the risk acceptance threshold and do not require active management, but does require periodic review to test its status.

HSE MANAGEMENT IMPROVEMENT PLANNING

HSE Improvement Plans (HSE IPs) describe the activities or tasks required to achieve the set HSE targets and objectives in terms of timetables, resources, responsibilities and reporting frequencies for the various tasks and actions required. An objective is the practical expression of the commitments made in a HSE policy, while targets are quantitative and should be achieved within a given period of time. Result from monitoring, audits and review are used to revise objectives and targets of these IPs. Legal compliance and new requirements from both Rio Tinto and international best practice are also incorporated into such plans.

HSE Management Improvement Plans are set for each high and critical priority hazard / aspect, while monitoring programmes are set for medium and high priority hazards / aspects to ensure that these remain well managed. There is on-going monitoring of moderate and low priority hazards / aspects to ensure they remain well managed and do not become high priority hazards / aspects.

The results of the HSE IPs are reviewed annually. During the operational review process, new activities, processes and HSE hazards / aspects are identified and incorporated into the database. New hazards / aspects are prioritised and programmed where required.

[4] The HSE hazards / aspects are defined as the parts of an organisation's activities, products or services that can interact with people, property, assets and the environment.

IMPLEMENTATION AND OPERATION

RESOURCES, ROLES, RESPONSIBILITY AND AUTHORITY

The HSE MS resources and reporting structures are outlined as follows:

1. *Managing Director*: Is accountable to the Board for all health, safety and environment matters, as the custodian of the Rössing Uranium HSE Policy.
2. *General Managers*: Ensure that the HSE policy is implemented and report to the Managing Director.
3. *HSE Manager*: Responsible for implementation of the strategic HSE MS, reporting directly to the General Manager: Operations.
4. *Departmental Manager*: Is responsible for the implementation of the operational HSE MS in each department.
5. *HSE Superintendents*: Appointed management representatives of the HSE MS, responsible for the overall implementation of the Rössing Uranium HSE MS and co-ordinates implementation efforts throughout all departments.
6. *Sectional Superintendent*: Is responsible for all HSE hazards / aspects in his/her work area and for ensuring that the objectives and targets as stipulated for each HSE hazard / aspect in his/her area are met within target dates stipulated in the relevant HSE Programme.
7. *HSE specialists:* Are responsible for monitoring the hazards / aspects and impacts of Rössing Uranium's operations to the health, safety and environment and assisting Departmental Managers and Superintendents with the implementation of the HSE MS in their respective work areas.
8. *Environmental Co-ordinator*: Assists the Departmental Manager and Superintendents with the implementation of the HSE MS by facilitating internal communication on environmental issues; setting up and the updating of Environmental Management Programmes and ensures that the operational HSE MS is aligned with the Environmental Management Programme for Rössing Uranium.
9. *HSE Officer:* Is responsible for the monitoring requirements within the department.

COMPETENCE, TRAINING AND AWARENESS

HSE specialists train employees and raise awareness in all contractors working on Rössing Uranium premises of the potential impacts their activities on the environment or on their health and safety, to ensure tasks undertaken are compatible with the Rössing Uranium HSE aims.

SUPPLIER AND CONTRACTOR MANAGEMENT

The Rössing Uranium HSE MS includes procedures to ensure that the procurement of equipment, materials, chemicals and services (including labour) fall within the acceptable HSE risk to the operation. This includes assessing potential suppliers of products or services on their ability to meet HSE requirements, appropriate to the assessed risk to the operation and ensuring that Material Safety Data Sheets (MSDSs) are supplied to Rössing Uranium prior to the delivery of such products. Equipment, materials and chemicals are received, stored and dispatched to and within the operation in accordance with HSE requirements and procurement standards are implemented to control any liability regarding the disposal of surplus, used materials, chemicals, equipment, and hazardous waste.

DOCUMENTATION AND DOCUMENT CONTROL

A policy for document control is in place for the HSE MS to ensure that appropriate procedures are available as required, that information is up-to-date and invalid or obsolete documents are removed from the system. The HSE Management Sections are responsible for the distribution, control, storage and collection of all such documents and records, which includes process information, organograms of responsible personnel, internal standards and operational procedures. Systems and compliance audits are undertaken to verify the document control procedure.

COMMUNICATION

The HSE MS ensures sound and effective communication and reporting structures so that hazards / aspects of concern are reported correctly, accurately and to the correct personnel. This allows for an appropriate response and the continual improvement of each of these aspects. The communication process in place also allows for changing requirements to be internalised and acted on, by way of the annual review process and by changes to the HSE policy and the HSE MS, as relevant.

Communication of HSE aspects: Roles and responsibilities:

Role	***Responsibility***
Managing Director	– Reviews the HSE section of the Rössing Uranium corporate report, before it is forwarded to Rio Tinto Headquarters.
General & Departmental Managers	– Accept reports on HSE performance.
HSE specialists	– Collect and interpret HSE data; – Report on HSE data and performance in HSE monthly; – Report annually on HSE data and performance in the Rio Tinto Social & Environment Survey and Stakeholder's Report; – Ensure communication and reporting of HSE issues at various levels & functions within their allocated departments.
HSE Superintendents	– Responsible for verification, content and quality of all HSE reports; – Approve all HSE reports prior to distribution by HSE staff; – Ensure on-going feedback and communication between all role players within the HSE MS structure.
Managers Health, Safety and Sustainable Development	– Generate annual HSE report, to be used as the basis for the annual review of HSE policy and strategies.
HSE Manager	– Compile data on the review of HSE performance in Rössing Uranium corporate report.

OPERATIONAL CONTROL

Operational control procedures have been put in place to limit HSE impacts from the activities of the company. The HSE Management Sections develop the procedure documents for operations and activities associated with the identified significant HSE hazards / aspects. They are also responsible for monitoring HSE hazards / aspects and recording the results in the HSEdatabase. The results are used to produce a monthly report on the priority monitoring results. Non-conformance is reported on at monthly HSE meetings or directly if required. HSE specialists assist in defining the corrective actions required for non-conformances, which Departmental Managers implement. The HSE investigation and reporting method is used to report on HSE incidents. Contractors adhere to the health, safety and environmental standards of Rössing Uranium at all times.

MANAGEMENT OF CHANGE

Change is regarded as any alteration to the facilities, equipment, procedures or operating conditions outside the intent of current established parameters. The HSE MS includes a Management of Change procedure. This goal is to ensure that proposed temporary or permanent changes will not result in increased risk to health, safety, environment, financial systems and operations processes. The Management of Change procedure requires that all affected personnel are notified of such changes, are empowered to manage any adverse situations that may arise and that all required paper work is completed to record any temporary or permanent change.

The Change Owner, as the individual assigned to implement the change, is responsible for ensuring that a change is co-ordinated and all affected personnel are fully informed. Change is then implemented throughout the relevant area and line managers, as appropriate, with the required documentation to record measures for auditing purposes.

EMERGENCY PREPAREDNESS AND RESPONSE

Rössing Uranium has emergency procedures in place for responding to emergencies and unexpected and uncontrollable situations. Emergency preparation and response procedures are generated on an on-going basis, based on a comprehensive risk assessment of the operations. These are reviewed and updated annually and distributed to all departments by the Protection Services. Emergency procedures are practised regularly across the mine, as initiated by the Protection Services section.

CHECKING AND CORRECTIVE ACTION

MONITORING AND MEASUREMENT

Measuring, monitoring and assessing Rössing Uranium according to the HSE MS has three purposes, namely to prove that the company is meeting legal requirements, to ensure that such data informs HSE improvements and to ensures that HSE impacts are controlled. The monitoring of HSE hazards / aspects is undertaken by the HSE specialists, who collect and maintain all HSE records, develop techniques and procedures for monitoring and define standards to be implemented. They also manage the monitoring process, communicate results of all monitoring to HSE Superintendents, who report performance on a monthly basis and compile monthly Health, Safety, Environment, Risk Management and Sustainable Development reports.

INTERPRETATION OF RESULTS

Effective communication and reporting structures to ensure aspects of concern from the monitoring results are reported correctly, accurately and to the correct personnel facilitate effective management of all HSE hazards / aspects of concern. The HSE specialists collate and undertake initial interpretation of HSE monitoring data, while the HSE Superintendents are responsible for the verification, content and quality of reporting, who approve reports before monitoring results are reported to line functions. HSE specialists communicate to affected sections when the HSE management programme needs to be adjusted, and facilitate the required changes in the programme.

NON-CONFORMITY AND PREVENTATIVE AND CORRECTIVE ACTION

The Departmental Managers are responsible for non-compliance reporting and investigation, allocation of resources for corrective action, and for ensuring the success of the corrective actions. Action is required when an HSE incident is reported, monitoring (or auditing) identifies negative impacts, non-compliance with Rössing Uranium standards and/or legal requirements or deviations occur from the targets and objectives set out in the HSE Management Programme. A response is also required when a complaint is received from a member of the public concerning any HSE hazard / aspect.

While HSE specialists can assist and facilitate implementation of corrective and / or preventive actions to minimise or prevent any HSE impact, the responsibility for the investigation and remedial actions rests with line management.

DATA AND RECORDS MANAGEMENT

Data relating to HSE management monitoring surveys conducted around the mine by the HSE specialists are stored in the HSE system. HSE records include collected HSE monitoring data; instrument calibration certificates; audit findings reports; and corrective actions stemming from HSE incidents and non-conformances. These records, as well as any other relevant correspondence (e-mails, photographs etc.) are stored either electronically or as hardcopies in the HSE filing system.

PERFORMANCE ASSESSMENT AND AUDITING

The Rössing Uranium Audit Programme allows for identification of HSE hazards / risks and verification of compliance with Namibian laws and relevant international regulations, as well as with the Rössing Uranium HSE policies and standards. The aim of this programme is to minimise potential liabilities by identifying areas where corrective action is required, to assess the HSE MS and the HSE performance against predetermined goals and targets.

REVIEW

A management review of the HSE MS takes place annually. This forms the basis for continuous improvement (an ISO 14001 and Rio Tinto requirement) and is the key to successful implementation of a management system. The purpose of the management review is to review HSE policy and policy strategies and HSE priorities, as well as the HSE objectives, targets and performance indicators. It allows for review of findings of HSE audits and reviews (internal and third party audits) and of the corrective and preventative action status. Opportunities for improvement and the need for changes to the HSE management system are identified and recommendations are made in this regard. The effectiveness of the HSE MS will be influenced over time by many factors, including changing legislation; expectations and requirements of interested parties; changes in the products or activities of the organisation; changes to the structure of the organisation and HSE system, as well as by lessons learned from HSE incidents.

The annual management review, which involves all departmental managers, allows for the identification of a number of focus areas. Objectives and targets for each identified focus area are set with each affected Departmental Manager and form the basis for demonstration of continual improvement in HSE performance, an essential element of any HSE MS.

The HSE Manager facilitates the Management Review, while the HSE Superintendents document the review and report on the performance of focus issues against set objectives and targets on an annual basis. An annual review report is communicated to all managers.

The annual review feeds into performance agreements for each department for the year. This allows for continuous improvement opportunities as tasks and actions are linked to the performance criteria for individual employees.

RÖSSING HSE MANAGEMENT SYSTEM

OUTLINE

Mining involves the removal of minerals from the earth's crust for utilisation. Because all mining activities cause some change in the natural environment, they all have a potential environmental impact. The extent of this impact ranges widely depending on the method of mining and the characteristics of the mine site and its surroundings. The Rössing Uranium EMS has been established to manage these impacts on an on-going basis through all stages of planning and operation, to decommissioning of the mine.

There are a number of policies and procedures that relate to the management of the full spectrum of potential impacts. An outline is given of the various strategies, policies and procedures in place to manage environmental impacts from Rössing Uranium's activities.

WATER MANAGEMENT

RÖSSING URANIUM'S WATER STRATEGY

Rössing Uranium promotes an integrated and strategic approach to water management, which includes maintenance and improvement of water quality, upstream and downstream minimisation of freshwater use and maximisation of reuse and recycling. The strategy is therefore applicable from exploration/development, through to closure. It covers all activities connected to water abstraction, dewatering, transport, storage and usage (potable and process) involving surface water (including runoff), impounded water and ground water.

Rössing Mine obtains fresh water from the Central Namib Water Scheme based at Swakopmund. The scheme is run by NamWater and draws groundwater from well fields in the Omaruru and Kuiseb rivers. Water users supplied from these sources include the towns of Walvis Bay, Swakopmund, Henties Bay and Arandis, as well as Rössing Mine, Langer Heinrich Mine and some smaller users.

Mining activities inherently have a significant impact on the environment in which they take place, both during operations and after closure. At Rössing Mine, water contamination is of particular concern to neighbouring communities, owing to the scarcity of water resources in the region. Rössing Uranium's environmental policy states that the company will employ management systems to prevent pollution or conditions that pose a threat to the environment and all required control systems have been established accordingly.

Water Supply:

- **Fresh Water Supply**

  Rössing Uranium originally planned to operate on fresh water only and the supply pipeline between Swakopmund and the mine was accordingly sized at 600mm diameter. During the first years of operation the mine consumed up to 10Mm^3/a of fresh water, which was supplied by the Department of Water Affairs (DWA) from the Swartbank well field in the Kuiseb River.

  During this time the Department of Water Affairs indicated that the Kuiseb River would not be able to meet the mine's entire water demand and Rössing Uranium investigated and developed an additional well field in the Omaruru delta (Omdel). When sufficient reserves were confirmed, the project was handed over to the DWA to construct a water supply scheme for the mine and Swakopmund. The well field consists of more than 30 boreholes in a palaeochannel of the Omaruru river north-east of Henties Bay.

To prevent over-abstraction of the ground water resources, Rössing Uranium started recycling in 1980 and the DWA investigated measures to increase the yield of the Omdel aquifer. For this purpose the Omdel dam and artificial recharge scheme was completed in 1994. A dam with a capacity of 40Mm^3 catches floodwater, which is released downstream of the dam wall when the mud has settled out. The clear water flows 6km on surface to an infiltration basin. The water infiltrates to the aquifer where it is protected from evaporation and can be abstracted via the existing boreholes.

The current bulk water supply agreement between Rössing Uranium and NamWater makes provision for a maximum supply of 17,000m^3/day and 4.5Mm^3/a of Group B quality water.

- **Freshwater Demand Planning**

The regional availability and sustainability of water resources is taken into account when planning the mine's water demand. The cumulative demand and impact of all water users are the topic of the Coastal Bulk Water Users' Forum (CBWUF) meetings. Participants give their water demand projections for the next 10 years to NamWater for long-term planning and infrastructure provision. They also discuss demand management measures and alternative supply sources. Information provided to the forum helps to assess supply assurance and impact on the water resources, so that Rössing Uranium's plans and water targets can be adjusted accordingly.

The mine's water demand is planned as part of the operating plan, which is a rolling five-year plan, updated in quarterly forecasts. The basic input is the tonnage of ore milled, because the major input and loss mechanisms are linked to production. The minimum demand can be calculated by considering the expected volumes of industrial water available for re-use. Another aspect that affects the freshwater demand is the implementation of improvement projects.

Having determined the overall water demand the Water Specialist allocates the available fresh water to the major users on the mine and proposes annual water consumption targets. These are discussed and signed off by the area owners. Major water users are engineering workshops, mining, reduction, extraction, tailings systems, domestic and fire.

- **Water Recycling and Re-Use**

The current water management system ensures that practically all process effluent is recycled, either directly from the paddy pond on the Tailings Dam or from the seepage dam and seepage control systems. Only a small volume of seepage reaches the underlying bedrock and dissipates into fractured bedrock whose permeability is too low for effective dewatering.

The tailings dam is situated in a basin formed by two sand-filled riverbeds in Pinnacle Gorge, which is a tributary of the Khan River. Rössing Uranium is obliged by law to ensure that no seepage from the tailings dam flows into the Khan River. Surface seepage from the toe of the tailings embankment flows down Pinnacle Gorge and is captured in the surface seepage collection dam 800m below the embankment from where it is recycled. Two cut-off trenches, further downstream, catch any water that may bypass the seepage dam.

Limited amounts of water from the tailings dam infiltrate into the underlying bedrock where fractures allow some movement of groundwater from the western side of the dam towards Panner gorge. This water is pumped out of dewatering boreholes, which are placed on all major fractures. Dewatering systems exist on the tailings itself, at the northern toe of the dam and west of the dam. A cut-off trench is placed across the lower Panner gorge to prevent inflow to the Khan River. Trenches and boreholes are pumped continuously to lower the water table. The recovered seepage is returned to the processing plant for re-use.

Daily monitoring of seepage control installations on the tailings dam is carried out by the Tailings Dam Area Operators, while the hydrogeologist evaluates the flow rates, water levels and general effectiveness of the systems.

- **Khan Water Supply**

For a long time the mine abstracted brackish water from the Khan River aquifer for industrial purposes, e.g. dust suppression. Pumping was stopped in January 2010 and small amounts are abstracted again after recharge occurred during the 2010/2011 rainy season. The well field is operated under certain permit conditions imposed by the DWA. The maximum abstraction allowed is 0.87Mm^3/a (2,384m^3/day), even though the internal Rössing Uranium target has been lower (600m^3/day). Another permit condition is biannual vegetation monitoring to ensure that the ecosystem is protected. The well field consists of five boreholes to pump to the Khan reservoirs at the mouth of Dome Gorge and from there to the Waste 4 pond north-east of the open pit and to reservoirs in Pinnacle and Panner Gorges, from where the water is transferred to the Waste 2 pond south-west of the pit. Any water that is not consumed by mining operations is pumped to the processing plant via the mine pond or the seepage dam and Lake Geoff.

- **Khan Vegetation Monitoring**

The sustainable yield of the Khan River aquifer was over-estimated in the past. During this time the average water level declined by 7m and it only recovered after recharge in 1997 and 2000. A hydrogeological evaluation in 1996 showed that the partly depleted aquifer could only sustain pumping rates corresponding to the inflow from upstream. Rössing Uranium Water Management now sets internal abstraction targets according to the available inflow and recharge, if any, and monitors the reserves available for abstraction monthly. Pumping will stop when the limit of 1.05Mm^3 remaining reserves is reached, so that base flow remains to sustain the vegetation.

The environmental impact of pumping was shown by vegetation monitoring, which is carried out twice a year according to DWA permit conditions and reported to the DWA. It was found that the mine's well field had affected the trees at some localities, but most of the deterioration was reversed after good rainfall. The depth to water is not that important, but the trees tend to suffer moisture stress if the water table is lowered by more than 0.1m/month.

- **Water Balance**

The Rössing Uranium water circuit is closed under normal operating conditions and no effluent is discharged. The water input balances the losses, so that the required volume of re-circulating process solution can be maintained. Water input to the mine includes fresh water supplied by NamWater, brackish Khan River groundwater when available, and saline groundwater from the open pit and the seepage control system, as well as moisture in ore and water in sulphuric acid.

Water losses occur due to evaporation from open water, e.g. from tailings pools, lakes, tanks, wash-down, and from entrainment of solution that will remain in the tailings material forever (estimated at 12% of dry ore milled). Other losses include water sprayed for dust suppression in the open pit. The water balance is developed in a spread sheet format and based on a process flow. It uses a large number of daily or weekly flow meter readings, which are retrieved by query from a water database. The water balance is updated monthly. Figure 4 provides a schematic of the Rössing Uranium water balance.

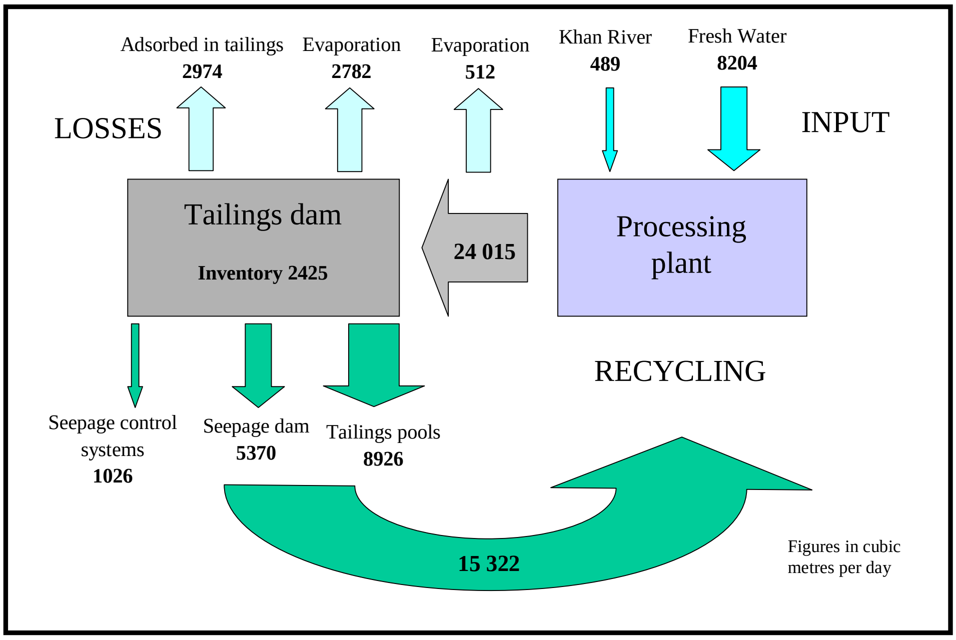


Figure 4: Schematic Rössing Uranium Water Balance

Water quality management:

- **Seepage Control Systems**

The tailings facility is a potential source of surface and groundwater contamination that needs to be controlled. The facility is situated in a basin formed by the confluence of two branches of Pinnacle Gorge and the combined stream drains towards the Khan River if uninterrupted. Cut-off trenches at Rössing Uranium were constructed in the early 1980s by digging trenches across the riverbed into the weathered bedrock and removing any loose material. One or two concrete wells were placed in the deepest parts of the trenches before the latter were backfilled with permeable sand and gravel. The wells are installed with electrical submersible pumps. The purpose of the trenches is to lower the water table below the bottom of the gorge and to remove groundwater flowing in the alluvium. This cuts off the major flow paths of potentially contaminated water towards the Khan River.

Small volumes of tailings seepage infiltrate into the underlying rock where fractures allow groundwater movement from the western side of the facility towards Panner Gorge. This flow is controlled by dewatering boreholes which are arranged in a double line on and along the western side of the tailings facility. Geophysical surveys were carried out to ensure that boreholes were placed on all major fractures. Many former dewatering wells are currently not in operation because their yield has declined to less than $1m^3$/day.

- **Water Quality Monitoring**

Rössing Uranium has established a water quality monitoring network consisting of over 100 monitoring sites which are periodically sampled and analysed. These are situated inside the mining licence and accessory works area as well as in the Khan and Swakop rivers. The purpose of the monitoring program is to confirm the functioning of the water quality control systems and to detect any unforeseen changes in water quality.

The natural groundwater quality in the vicinity of Rössing Mine is very saline with total dissolved solids (TDS) concentrations of 20,000mg/ℓ to 40,000mg/ℓ on the desert plains in the north-west. The water quality improves gradually to TDS <10,000mg/ℓ in a south-easterly direction towards the Khan River. The tailings facility creates an anomaly of more saline water (20,000mg/ℓ to 40,000mg/ℓ) in an area of naturally intermediate salinity (10,000mg/ℓ to 20,000mg/ℓ). The tailings solution itself is highly saline (>40,000mg/ℓ), but it is reused in the uranium extraction process and not allowed to interact with the environment.

Groundwater quality data for the Khan and Swakop Rivers indicate a variable composition that improves after floodwater recharge, but generally deteriorates with distance downstream. Khan groundwater in the vicinity of the mine is brackish with an average TDS concentration around 5,000mg/ℓ. The lower courses of the Khan and Swakop Rivers contain brackish to saline groundwater that is not suitable for human consumption.

Flowing rivers in the vicinity of the mine are only found after heavy rainfall. Flood water quality analyses of the Khan River indicate that the total dissolved solids content of flood water can be quite variable. Samples taken during the 1970s showed an increase from 261mg/ℓ at Usakos to 877mg/ℓ at the Khan/Swakop confluence. Samples of the 1995 flood varied from 270mg/ℓ to 430 mg/ℓ at the mine to 730mg/ℓ in the Swakop River just downstream of the confluence. The only other natural surface water is found in small springs or ground water seeps, three of which are located within a radius of 15km around the mine. Even though the spring water is saline animals sometimes make use of it.

The quality of groundwater within the mining licence and accessory works areas has been affected by Rössing Uranium's operations. The main contamination sources are the mineral waste sites (tailings facility and waste rock dumps), while the impact of the processing plant and various landfills is more localised. Superimposed on the regional groundwater flow pattern with south to south-westerly directions is the local recharge mound created by the tailings facility that drives the flow of ground water in all directions.

The environmental impact of seepage is reduced by chemical reactions inside the tailings dam, which remove most of the acid and chemicals contained in the tailings solution. Tailings contain an average of 0.5% carbonate, which neutralizes sulfuric acid to gypsum and carbon dioxide. Other chemical reactions lead to the precipitation of iron hydroxides and co-precipitation of heavy metals and radionuclides. For instance, the TDS concentration of tailings solution is 40,000mg/ℓ, but the seepage emanating at the toe of the facility has only 14,000mg/ℓ TDS.

Seepage is mainly characterised by increased sulfate, nitrate and magnesium concentrations, while chloride and sodium predominate in natural groundwater. The "seepage plume" around the tailings facility has always been defined by the 3,000mg/ℓ sulfate contour, while natural groundwater usually contains less than 2,900mg/ℓ sulfate. The objective of water quality management in the mining area is to prevent, as far as possible, any expansion of the seepage plume beyond the area it occupied in 1999. Monitoring results since 2000 confirm that the plume did not spread outwards, but rather retreated in some places.

- **Water Regulations**

The South African Water Act (Act No 54 of 1956) is still in force in Namibia, though the new Namibian Water Act of 2004 is expected to be enacted soon. The associated regulations mostly date from the 1970s and are not in line with modern environmental concepts. New regulations are expected in the near future.

The government agency controlling Rössing Uranium's water management programmes is the Department of Water Affairs (DWA) in the Ministry of Agriculture, Water and Forestry. Two major permits have been issued: 1) An industrial and domestic effluent discharge permit (current number 385); and 2)

An abstraction permit for the Khan River well field. Additional permits are required whenever new boreholes are drilled in public streams (e.g. Khan and Swakop rivers).

The objectives of the industrial and domestic effluent permit as stated by the DWA are to regulate the disposal of effluents produced by the mine and to prevent the spread of ground water pollution from effluent or waste disposal sites into the mining licence area or the Khan River. The wording of the permit is in fact an anachronism since Rössing Uranium does not discharge any effluents, but re-uses water from all sources. It has been retained for historical reasons and the intention of the permit still serves to maintain the necessary level of regulatory supervision. Water quality criteria are however not included in the permit conditions.

Rössing Uranium has standard operating procedures for water quality management and several related procedures to ensure compliance with DWA permit conditions.

- **Compliance with Rio Tinto Water Use and Quality Control Standard**

  A formal Water Management Plan (WMP) is required by the Rio Tinto environmental standard "Water Use and Quality Control". A WMP has been compiled to give an overview of all issues related to water management at Rössing Uranium and prepared in accordance with the Rio Tinto Water Use and Quality Control Guidance Notes.

  The intent of the standard and of the WMP is to ensure efficient, safe and sustainable use and protection of water resources and ecosystems in and around Rio Tinto operations. This requires an understanding of the water resources, their spatial and temporal interrelationships, their ownership in the region and the needs of key catchment stakeholders.

  The understanding provides the basis for the development of an integrated and strategic approach to water management that promotes the maintenance or improvement of water quality, upstream and downstream, minimisation of fresh water use and the maximisation of reuse and recycling.

  Figure 5 summarises the information above.

RADIATION

RADIOACTIVITY AT RÖSSING URANIUM

Rössing ore contains on average of 350g/t uranium and radioactivity is low. The total radioactivity per gram of ore is typically 60Bq. A Becquerel (Bq) is the number of disintegrations per second and is the SI unit for measuring the level of radioactivity. Uranium is extracted from the ore using an open pit mining, crushing, milling and metallurgical extraction process. After milling, the radioactivity is concentrated by the metallurgical extraction process. The radioactivity along the production process ranges from 60Bq/g in the ore to 380Bq/g in OK liquor. The majority of the radioactivity entering the processing plant ultimately ends up in Rössing's commercial product - uranium oxide (U_3O_8) - at levels of about 21,000Bq/g. The remaining radioactivity from the ore, which is associated with the rest of the daughter radionuclides in the uranium decay chain and those in the thorium series, is deposited to the tailings impoundment, along with other mineral waste. The radioactivity level in the tailings is typically 50Bq/g.

The processing of bulk uranium containing materials also leads to the formation of radioactive scale on equipment within vessels and pipes. Radioactivity from the above materials and process chemicals can lead to exposure to workers, and/or the contamination of the soil, air or water in the vicinity, and will require remedial measures during operation and at closure. Radioactivity also occurs in dust generated by the mining and milling process which is dispersed by wind. Finally, the extraction and size reduction of ore results in an increase of radon concentrations in the environment, both within the borders of the mine site and beyond.

TYPES OF RADIATION

Radiation is classified into non-ionizing and ionizing radiation, depending on its energy. Radiation is ionizing if its energy is high enough to remove an electron from an atom or molecule. The radiation which is emitted from radionuclides during radioactive decays falls into the category of ionizing radiation and can be grouped into the three types:

- **Alpha**

  The alpha particle is the nucleus of the element helium and consists of two protons and two neutrons. Because of its large mass and its charge, it has short range and is easily stopped by a sheet of paper or by human skin. External exposure to alpha radiation is harmless because it is stopped by the dead outer skin layers. Its main radiation hazard arises when ingested or inhaled into the body, where it can come into contact with living cells. Internally, alpha radiation is the most strongly ionizing type of radiation.

- **Beta**

  Beta particles are electrons or positrons which are emitted from the radioactive nucleus. These high energy electrons have a greater range of penetration than alpha particles, but less than gamma rays. Because beta particles are roughly 8,000 times less massive and only half as charged as alpha particles, beta radiation is about 3 orders of magnitude less ionising than alpha radiation.

- **Gamma**

  Gamma rays are high-energy electromagnetic waves, distinguished from x-rays only by their nuclear origin. Most gamma rays are higher in energy than x-rays and therefore are very penetrating. Because gamma radiation is uncharged and massless, it does not interact as easily with matter as alpha and beta particles. It is therefore less ionising than alpha or beta radiation, but much more penetrating and can easily pass through the human body.

URANIUM

Naturally occurring uranium has a three isotopes, the most abundant being uranium-238 (99.3 weight %), followed by uranium-235 (0.7 weight %) and uranium-234 (0.005 weight %). All three uranium isotopes are weakly radioactive, with specific activities of 12,445Bq/g (U-238), 80,011Bq/g (U-235) and 231.1MBq/g (U-234) respectively.

When uranium and thorium decay, a series of daughter nuclides result, with one element decaying into the next one until a stable isotope of lead is reached. The relevant decay chains are referred to as the uranium series (starting with U-238 and containing U-234 as a daughter in the decay chain), the thorium series (starting with thorium-232, Th-232), and the actinium series (starting with U-235).

As per hazardous materials definition, low toxicity alpha emitters are defined as “natural uranium, depleted uranium, natural thorium, U-238, U-235, Th-232, Th-228 or Th-230 when contained in ores or physical or chemical concentrates or tailings, or alpha emitters with a half-life of less than 10 days”. Both the mined ore as well as the final product, (U_3O_8), at Rössing Uranium therefore fall into the category of low toxicity alpha emitters.

SOURCES OF RADIATION

Most of the radiation occurring at the Rössing mine originates from the uranium, actinium and thorium decay chains. Because of the low ore grades, radiation levels in most areas of the mine are low, except for the areas in the plant where concentration of uranium takes place.

Radioactivity in excess of the natural background radiation specific to the area enters the environment through the redistribution of rock materials by mining out the open pit, placing material on rock dumps and placing tailings into the tailings repository.

Exposure to radiation can be grouped into two categories: internal and external exposure.

- **External exposure**

  External exposure is exposure from sources external to the body, and is from gamma radiation only. Sources for external exposure at the mine include the ore body, stockpiles, tailings impoundment, plant area, final product and sealed radiation sources. Exposure levels range from 0.2µSv/h (micro Sieverts per hour) at offices to 10µSv/h at final product recovery.

- **Internal exposure**

  Internal exposure can come from all types of radioactive materials if they are inside the body. Once inside, much of the radiation energy will get absorbed in cells, tissue and organs. Internal exposure can be grouped according to three internal exposure pathways: The inhalation of long-lived radioactive dust (LLRD), inhalation of radon and radon progeny, and ingestion of radionuclides.

- **Sources not related to uranium**

  Eighteen sealed radioactive sources are used at the mine for density and level measurement and uranium analysis purposes in the primary crusher, rodmills, thickener, Continuous Ion Exchange and SX areas of the processing plant. Source materials are Cs-137, Cd-109 and Am-241 with activities ranging from 0.39GBq to 37GBq. Thirteen unused sources are stored in the radiation store of the mine and need to be returned to the supplier or the national interim waste storage facility once available. An X-ray machine belonging to the medical contractor is operated at the Mine Medical Centre.

OCCUPATIONAL RADIATION PROTECTION PROGRAMME

Occupation Dose Limits

Monitoring and modelling programmes will be carried out, the purpose of which will be to determine the natural background radiation levels, the enhancement of these background levels due to the mining operations, and the associated radiological doses to members of the public. The company will ensure that the effective dose equivalent to employees is limited according to the recommendations of the ICRP (ICRP, 1991):

Tissue	Annual Dose Limit (mSv)
Effective Whole Body Dose	20mSv in one year **
Equivalent Dose • skin • lens of eye	 500mSv 150mSv

** A higher value of the effective dose is allowed in a single year provided that the effective dose over 5 years does not exceed 100mSv.

- **Similar Exposure Groups (SEG)**

  All workers are grouped into SEGs according to the potential radiation exposure experienced in the area.

- **Radiation Workers**

  A radiation worker is defined as someone having to work for extended periods in areas designated by the Manager HSE and Risk Management and is assigned as such in the health register. Rössing's designated radiation workers include:

  - Employees working in Final Product Recovery, Continuous Ion Exchange and Solvent Extraction for more then 400 hours in a year;
  - Radiographers and X-ray equipment operators;
  - Employees involved with the descaling of pipes and equipment; and

- Any other employees designated by the Manager HSE.

Typical Exposures by Area

Occupational exposures depend on the radiation levels in the area as well as on the time spent in the area and the effectiveness of controls such as dust containment or time restrictions.

- **Classification of Areas**

  In order to more effectively and consistently regulate occupational exposure to ionising radiation, workplaces are designated as either “controlled” or “supervised” areas.

- **Controlled Area**

  This describes an area where personal exposures may potentially exceed 7mSv / annum (one third of the annual limit) or which require control. These areas include:
  - Final Product Recovery, including Solvent Extraction;
  - Product storage yard;
  - Radiation Store for sealed sources;
  - Sealed Sources in use;
  - Diagnostic X-ray Room at Mine medical centre; and
  - Decontamination Facility.

  In areas where sealed radioactive sources are installed these areas will be regarded as controlled areas and such areas will be safely enclosed and radiation warning signs will be displayed in prominent positions.

  All controlled areas are fenced and entry gates to the areas are locked. Access is restricted to personnel having to work in the area, who undergo an area specific induction programme before being granted access to the area. Access is by electronic access control using fingerprint identification.

- **Supervised area**

  This describes an area where exposures are above the general background of the area and may potentially exceed 5mSv/a. Areas defined are:

  - Open pit;
  - Crushing, Milling, Coarse Ore and Fine Ore Stockpiles;
  - Leaching, Rotoscoops and Thickeners;
  - Continuous Ion Exchange (CIX);
  - Tailings Impoundment;
  - Gritblasting Yard; and
  - Chemical Laboratory (X-ray & Final Product Recovery analysis rooms).

  Access to these areas is restricted by local departmental standard procedures. All these areas are fitted with electronic access control activated by personal electronic access cards, restricting access to those persons authorised to work in the area.

- **Non classified areas**

  Non controlled areas include those areas not listed under controlled or supervised areas. Conditions in these areas will be reviewed biennially to determine the need for reclassification.

MONITORING

External radiation exposure

Workers working in the radiation controlled areas are designated radiation workers. Each worker is registered as a radiation worker with the South African Bureau of Standards (SABS) and is issued with a thermo-luminescent dosimeter (TLD) monthly. TLD dosimeters will be worn at all times during working hours. The dosimeter will be pinned onto the clothing in the area of the chest or at waist level for employees handling final product drums. Analysis of TLD's is performed by the SABS each month and reported to the Radiation Safety Section for record in the health register. Workers not designated radiation workers comprise all groups except Final Product Recovery and Recovery Staff. External exposure of non-radiation workers is monitored randomly, per SEG, using electronic personal dosimeters.

Internal Radiation Exposure:

- **Long-lived radioactive dust LLRD**

  Inhalation of long-lived radioactive dust (LLRD) is monitored and the inhalation dose obtained from the exposure to long living alpha and beta nuclides (LLRD) in the breathing air.

- **Radon progeny**

  Exposure to radon progeny is monitored to determine the exact exposure obtained by the short living radon daughter products (progeny) in the air breathed.

- **Pregnant women**

  Unborn babies are regarded as members of the public and as such are subject to the 1mSv/a maximum exposure limit. In some areas, in particular areas in which workers are classified as radiation workers, this 1mSv/a limit will be exceeded, making it necessary for pregnant employees to be moved out of the area for the duration of the pregnancy.

  Once an employee is aware that she is pregnant she needs to inform the Medical Service Provider, her Line Manager or the Wellness Co-ordinator immediately. A comprehensive hazard and risk assessment will be completed in order to compile an Occupational Risk Exposure Profile (OREP) for that particular case. This will be done by the Health Management section together with the Occupational Physician. If required alternate work will be sought for the employee during pregnancy.

Medical surveillance

Management makes provision for biannual medical examination of all designated radiation workers, or at such times when over exposure is suspected. This is in addition to the annual medical health examination based on workplace health exposures prescribed for all employees.

Surface contamination

Rössing Uranium also monitors surface contamination. Surface contamination results when uranium containing material settles on, or spilled uranium solution dries on, surfaces. This contamination, unless controlled, can become suspended in air and become an inhalation risk, or it can be a source of external radiation to the skin. Surface contamination is mainly controlled through an Access/Egress control programme for personnel, vehicles, and equipment, scrap and process materials.

Surface contamination can be regarded as being either fixed or non-fixed (removable). Non-fixed contamination refers to contamination that can be removed from a surface during routine handling or transport. Fixed contamination refers to contamination bonded to the surface quite firmly by chemical or physical means such as chemical bonding, adsorption, adhesion, and so on and that cannot be easily removed from the object. Both fixed and non-fixed contamination contribute to local beta and gamma dose rates, but only non-fixed (removable) contamination can be re-suspended and contribute to air contamination. Thus non-fixed (removable) contamination is therefore, more hazardous and are controlled by removal, e.g. wash downs with subsequent recycling or disposal of the wash down solution.

Objects, items or equipment which are not radioactive but which have radioactive material distributed on its surfaces are known as surface contaminated objects (SCO). Contamination means the presence of a radioactive substance on a surface in quantities in excess of $0.4Bq/cm^2$ for beta and gamma emitters and low toxicity alpha emitters, or $0.04Bq/cm^2$ for all other alpha emitters.

Investigation and action levels

Dose equivalent limits are set that will serve to trigger investigation procedures into the cause of the higher doses measured. The investigations are to be conducted by the Radiation Safety section. The investigation levels are as follows:

- **Controlled Area**

  An investigation will be conducted when the estimated annual dose equivalent (monitored by direct reading dosimeter, dust and radon progeny monitoring) exceeds 15mSv.

- **Supervised Area**

  An investigation will be conducted when the estimated annual dose equivalent (monitored by direct reading dosimeter, dust and radon progeny monitoring) exceeds 5mSv. The daily limit for external radiation is 80μSv, and alarms are set to sound if this daily limit is reached. Employees are required to leave the area for the remainder of the shift after reaching the daily limit.

- **Personal External Radiation Exposure**

  An investigation will be conducted when the monthly personal external dose equivalent (monitored by TLD) exceeds 1.6mSv.

Procedure in case of accidents/incidents

Following all accidents/incidents involving radioactive spillage, contamination or when a radiation dose in excess of 1.6mSv for a four week period has been recorded for an employee, an investigation into the cause will be carried out by the Manager HSE. The Manager HSE will then submit a detailed account of the occurrences to the Managing Director.

Personal protective equipment (PPE)

When engineered and operational controls are not sufficient to provide an optimized level of protection for the tasks to be performed, personal protective equipment should be used. Depending on the risks of contamination, respirators, dust masks, overalls, head coverings, gloves, impermeable footwear, underclothes, towels and socks will be provided by the company. Changing from work clothes to personal clothing and vice versa will be done in the change houses provided. Protective clothing and equipment used on site will remain on site and only be cleaned on site to prevent inadvertent exposure of families to potential health hazards. Protective clothing used in Final Product Recovery will only be cleaned in the Final Product Recovery laundry. No other clothing, including personal clothing from other areas, will be washed in the Final Product Recovery laundry.

The Respirator Workshop conducts fit tests and maintenance of all respirators. Supervisors ensure that their subordinates are presented to this workshop for respirator fitting. Respirators are inspected before wearing by the employee and at appropriate intervals by the supervisors. Damaged and defective respirators are sent to the Respirator Workshop for maintenance. Supervisors also ensure that respirators reach the respiratory workshop for routine maintenance as per a schedule.

Personal respiratory protection is worn where there is a possibility that airborne contamination could exceed three tenths (3/10) of the Daily Allowable Concentration . The use of respirators is carefully supervised to ensure that the expected protection is provided. Operations and maintenance supervisors ensure that the respirators are fitted and used properly. Only the type of respiratory protective equipment approved by the Health Management section is used.

Personal hygiene

- **Facilities**

The company ensures that adequate ablution, laundry, change houses, kitchens and lunch rooms are available for all its employees. All facilities, (e.g. ablutions, toilets, change rooms, lockers, kitchens, lunchrooms) are kept in a clean and hygienic state.

No person should eat, drink, chew gum or tobacco, smoke or take snuff in working areas where concentrated radioactive materials may be ingested or inhaled. Lunchrooms in these areas are provided with adequate washing facilities.

Before eating and before leaving the mine site, employees ensure that an adequate level of personal cleanliness has been achieved. This includes the washing of hands and faces before eating or drinking and showering, if possibly contaminated, before leaving for home.

Storage of food, eating, drinking or smoking will only be allowed in approved lunchrooms and smoking areas. No food may be kept in lockers, tool boxes etc.

- **Dust monitoring and control**

The degree of dust control implemented provides adequate protection of workers against non-radioactive dust hazards. In the mining of radioactive ores this is sufficient to reduce the airborne concentrations of radioactive ore dust to meet the requirements of the dose limits given.

The following measures are followed:

- The generation of dust from operations is minimised by the use of appropriate mining techniques such as proper blasting patterns and timing, use of water, dust suppressants, etc., and the use of appropriate equipment;
- When dust is generated, it will be suppressed at the source where possible;
- Where dust control methods do not achieve acceptable air quality, enclosed operating booths with filtered air supplies are provided for the workers. This approach can be particularly useful for equipment operating in an uncontrolled environment; and
- Personal dust monitoring is conducted for all work groups and their radiation dose caused by the inhalation of dust assessed.

- **Medical surveillance**

All designated radiation workers (whether they are Rössing employees or contractors) are examined prior to appointment or employment as prescribed above, and as laid down in the Rössing Medical Standards. The term "first employment", means first employment as a designated radiation worker and also re-employment followed by any cessation of such employment for a period exceeding 12 months.

Designated radiation workers will be examined at regular intervals as determined by the Occupational Physician provided that the medical examinations will be conducted:

- At intervals of not more than 24 months for designated radiation workers working in supervised areas and 14 months for designated radiation workers working in controlled areas or as long as employment as a designated radiation worker continues;
- Where over-exposures to radiation are expected or have been established; and
- At such other times as the appointed doctor in his/her discretion deems it necessary.

It is required of all designated radiation workers to submit themselves for medical examinations in accordance with the provisions of these conditions.

Any person who has been employed previously as designated radiation worker shall provide details of the employment, viz. accumulated doses of radiation (external and internal) and the name and details of previous employer.

- **Medical examinations**

  In the interest of the health of employees, Rössing requires that employees undergo medical examinations in the following instances:
  - Prior to employment;
  - Periodically during employment;
  - Upon termination of employment; and
  - When a designated radiation worker has received an over exposure.

  All temporary employees are required to undergo radiological examination of the chest prior to employment. Chest X-rays are taken on site at a pre-arranged time. Employees who are going to work in a radiation area undergo a full examination before employment and upon termination of employment. Temporary employees who spend more than three months of the year on site should undergo a full medical examination before and upon termination of employment.

PUBLIC EXPOSURE MONITORING PROGRAMME

Public Dose Limits

Monitoring and modelling programmes are carried out, the purpose of which is to determine the natural background radiation levels, the enhancement of these background levels due to the mining operations, and the associated radiological doses to members of the public.

The company ensures that the effective dose equivalent to members of the public as a result of its operations is limited according to the recommendations of the ICRP (ICRP, 1991):

Tissue	Annual Dose Limit (mSv)
Effective Whole Body Dose	1mSv in one year **
Equivalent Dose • skin • lens of eye	 50mSv 15mSv

** A higher value of the effective dose is allowed in a single year provided that the average over 5 years does not exceed 1mSv per year.

Public Dose Constraints

In accordance with Namibian legislation, the optimisation of the radiation safety measures must satisfy the condition that the resulting doses to the individuals of the public do not exceed dose constraints which are equal to **one quarter of the dose limits**, or any lower values as may be established by the Authority.

Public Exposure Pathways

Exposure of members of the public to ionizing radiation as a result of uranium mining could occur along three possible pathways: the aquatic pathway, via atmospheric dust and via radon gas. The exposure of humans to radiation can occur directly from the outside (external), or internally through ingestion or inhalation. The most relevant pathways for the exposure to ionising radiation as a result of mining activities are as follows:

- Direct exposure to external gamma radiation.
- Atmospheric pathway: Inhalation of dust containing radionuclides.
- Atmospheric pathway: Inhalation of radon progeny. Radon exhalation, in addition to the natural radon exhalation of the area, is presented mainly by the tailings dam, which contains finely ground particles from which radon can escape to the environment. Further sources of increased radon exhalation are the waste and ore stockpiles, crushing circuits and open pit areas

- Aquatic pathway: Radioactivity can enter the environment via the aquatic pathway in the form of seepage water that contains dissolved radionuclide salts.
- Ingestion: Radionuclides can be ingested directly, or swallowed after inhalation of dust.

Receptors and Critical Groups

Receptors are those people who could potentially receive a radiation dose from the mining related sources, via the three pathways specified. By definition, the critical group is that group of people who can be reasonably expected to receive the highest dose from a source, or group of sources, under consideration.

Groundwater: The Aquatic Pathway

For groundwater, a pathway could potentially constitute:

- People consuming borehole water for (some of their) drinking;
- People depending on crops produced using borehole water for irrigation; and
- People depending on animal products from animals raised using borehole water for drinking, and feeding on crops produced using borehole water for irrigation.

The effective dose as a result of ingestion of radionuclides via the groundwater pathway depends on the following factors:

- Radionuclide concentration and chemical composition of seepage;
- Subsurface and surface flow velocities of waterways;
- Age distribution of critical groups;
- Percentage of use of own grown crops versus crops imported from elsewhere;
- Percentage of borehole water used for drinking, versus imported bottled water (the water in the Swakop and Khan Rivers is brackish and often not suitable for drinking purposes);
- Percentage of animals and animal products consumed versus animal products imported; and
- State of equilibrium between water and soil relating to radiological activity (water and soil may take hundreds of years to reach a state of equilibrium).

Atmospheric Pathways

For an assessment of the dose to humans resulting from fugitive dust, the following factors have to be considered:

- Sources of dust;
- Chemical composition and particle size distribution of dust;
- Radionuclide content of dust;
- Meteorological conditions such as wind speed and wind direction;
- Age distribution of critical groups;
- Rate of uptake of radionuclides by different crops from deposited dust;
- Percentage of use of own grown crops versus crops imported from elsewhere;
- Percentage of animals and animal products consumed versus animal products imported; and
- Percentage of milk and milk products produced by own cattle, versus imported products.

Dust emissions can be controlled to a considerable degree: for example, spraying roads in the open pit areas reduces dust spread by haul trucks; containing crushing plants within buildings reduces the amount of dust spread to the environment, and keeping the surface of tailings dam moist can further reduce the hazards presented by fugitive dust. Another remediation option for tailings dams after mine closure is presented by covering the tailings dam areas by a layer of rock to prevent any dust from escaping the surface.

Detailed atmospheric dispersion modelling is required to fully evaluate the distribution of radon from its sources to areas of concern, such as towns and villages, and also for impacts of dust containing long-lived radioactive nuclides.

Control of Visitors

Visitors are members of the public and as such should not be exposed to an annual radiation dose as a result of the mining practices exceeding 1mSv per year.

Visitors shall be issued with the PPE prescribed for the area of the visit. Visitors to the Controlled Areas shall be issued with electronic dosimeters. Eating and drinking is not allowed, except in the approved lunch rooms, and care are taken to wash hands before eating and drinking. Smoking is not allowed except in approved areas, and hands are washed before smoking.

Contractors shall be regarded as workers, for whom the annual dose limit of 20mSv applies. Contractors are required to wear the PPE prescribed for the area of their work, including the respirators approved by Rössing Uranium where these are prescribed for the area.

All protective equipment and clothing is to be supplied to visitors or contractors by Rössing.

Public Dose Assessments

Public dose assessments are performed for each mine extension, and for each mine closure plan. The dose assessments require the consideration of detailed information about the exposure pathways, critical groups, meteorological conditions and source terms for groundwater contaminations, dust emissions and radon exhalations. External consulting companies are customarily employed to perform public dose assessments based on the data provided by Rössing and are required to submit detailed reports specifying procedure followed and methods of assessment.

Equipment Requiring Maintenance

All equipment or materials which are in use in the plant and that require maintenance work and that needs to be sent to another area of the mine site, e.g. workshops, require a radiation clearance following the criteria given below. All items and equipment requiring a radiation clearance should be opened up in such a way so that all surfaces that are normally concealed would be accessible for radiation monitoring e.g. a pump should be opened up so that contamination readings can be taken on the inside of the pump. Items with inaccessible surfaces will not be granted a radiation clearance. No item is to be accepted for example at a workshop if no radiation clearance certificate is issued.

Removal from Site

All items to be transported off the mine site require clearance from Radiation Safety section following the contamination standard given in the IAEA Transport Regulations (IAEA, 2005).

The levels of contamination of material and equipment for the release from controlled and supervised radiation areas to uncontrolled radiation areas in the public domain should not exceed the limit of 0.4Bq/cm^2.

Uranium Bearing Ore Samples

Uranium ore samples are sometimes transported to laboratories off site, either within Namibia or across its borders.

Any ore sample containing natural uranium, with an activity of 1Bq/g (from uranium alone), or with a total activity of 1,000Bq or more, may be transported only if a permit is obtained from the National Nuclear Regulatory Authority for such a transport. For ore samples, an activity density of 1Bq/g from uranium alone is obtained with an ore grade of 40ppm or more.

Packaging

Ore samples are placed in sealed air and watertight bags for transport. If the size of the sample exceeds 1kg, the sample is additionally packed in a lidded box or a lidded drum, which can be sealed for transport. The package or container is labelled with the IAEA Category-I-WHITE label, 10cm in length and specifying "Contents: Low Specific Activity Material: uranium ore" and the activity of the sample. A consignment note specifying the quantity and activity of the sample accompanies each transport of ore samples.

Transporting

Each transport is accompanied by a MSDS about uranium bearing ore. The MSDS specifies the hazard identification, first aid measures (none), fire fighting measures (none), accidental release measures (spillage removal), handling and storage instructions, personal protection measures, physical and chemical properties, stability and reactivity, toxicological information, disposal considerations and transport information.

A clearance from Radiation Safety are be obtained for each transport of uranium bearing ore.

Figures 6 and 7 summarise the information provided above.

HAZARDOUS MATERIALS AND CONTAMINATION CONTROLDEFINITIONS

Hazardous materials are broadly defined as any substance or article (solid, liquid or gas) that poses a threat to human health and/or the environment. Typically hazardous materials are toxic, corrosive, flammable, explosive or radioactive. Included are a wide variety of man-made (i.e. synthetic) and naturally occurring (e.g. metals such as zinc and copper) substances. These materials are a necessary part of our modern life, helping human activities and development, preventing and controlling many diseases and increasing agricultural productivity. However, when misused, they can adversely affect the environment and our health and safety.

Hazardous materials include acids, caustic, lime, pesticides, explosives and petrochemicals, to name a few of the more obvious. Other substances not commonly regarded as hazardous, but which can be under certain circumstances, include brick dust, detergents, disinfectants, degreasers, glues, paints and aerosols.

All hazardous substances are controlled and assessed in line with the Hazardous Substance Ordinance of 1974. As a result of limitations and best practice, the Code of Practice (COP) for Control of Substances Hazardous to Health have been developed and all Rössing hazardous material are purchased, handled and stored according to this code of practice

RISKS

1. Loss or property and even life through fire or explosion;
2. Exposure to hazardous or toxic substances could result in illness, ill health or death;
3. Loss of flora or fauna;
4. Contamination of soil or ground water; and
5. Contamination of the airways.

RISK ASSESSMENT

The purpose of the assessment is to enable decisions to be made about appropriate control measures, induction and training, monitoring and health surveillance as may be required by legislation.

The threat posed by a material to the environment depends on what the material is, its concentration, its mobility, how it is transformed and how long organisms are exposed to it.

It is important to know and understand the characteristics of materials before it is purchased. Thus, all material needs to be assessed and /or confirmed from the suppliers whether the material is:

- Dangerous;
- Hazardous;
- Poisonous; and
- Does the material require a Hazchem code?

A risk assessment is conducted on intended usage of a new substance as part of the approval process to enable decisions to be made about appropriate control measures, training, monitoring and health surveillance that may be required.

- **Material Safety Data Sheets (MSDSs)**

  Information about substances used at Rössing can be readily found on MSDSs and on container labels.

  The MSDSs provide adequate and appropriate information about the chemical/material as it is to be used in the workplace; i.e. during its foreseeable 'life cycle'. This information includes the environmental characteristics of the material and how best to prevent adverse environmental impacts in the event of escape. It is thus important that the product's recommended use is adequately described. MSDSs are prepared by the manufacturers of the material and are also available through suppliers of the products.

- **Inventory**

  Once chemicals have been authorized, it is placed on Rössing Uranium's intranet network where it is updated by the Environmental Technical Support Section and Supply Chain Management Section.

SUPPLY MANAGEMENT

For the purposes of ensuring environmental awareness and environmental sustainability, all products purchased at Rössing will be according to the environmental procurement guidelines. The guideline stipulates that all products purchased by Rössing should comply with the *buy green* notion. Thus ensuring that all products are environmentally friendly before it arrives on site.

Permission to bring new substances onto site is required and can be sought through use of the "Chemical Authorisation Sheet".

All purchased chemicals have MSDSs for the chemicals supplied with it. Where a supplier cannot or will not provide an acceptable MSDS, an alternative supplier will be considered.

STORAGE

Storage areas for hazardous substances comply with conditions as specified in local regulations and standards, and with the requirements of Rio Tinto Environmental Standard. Hazards associated with storing hazardous goods include:

- The potential for injury or environmental harm resulting from not segregating incompatible hazardous substances;
- The potential for release of contaminants to waterways, land or atmosphere due to leaks or spills outside bunded areas; and
- Injury or illness resulting from short or long term exposure to hazardous substances due to leaks or inappropriate handling or packaging.

- **Chemical store facilities**

  All bulk hazardous substances (e.g. acid, ammonium, ammonia nitrate, manganese and fuel) arrive on site by means of either rail or road tankers. Once on site, the hazardous substances are pumped into bulk storage tanks from where it is pumped to the final user. Ammonia nitrate is stored in an enclosed building whereas manganese is stored in an open bunded area.

  Flammable hazardous material is stored in steel cabinets mine wide, which are painted red and have appropriate signage indicating that flammable hazardous material are being stored inside.

  Industrial hazardous materials/substances are stored in the chemical store situated at Receiving (stores). The layout, construction and size of the chemical store are in line with the National Fire Protection Association (NFPA) Standard of America.

All the storage facilities for hazardous material/substances on site have to conform with the Rio Tinto Environmental Standard and are subjected to internal and external HSE audits.

- **Enclosed systems**

Acid, anhydrous ammonia and diesel are the only hazardous substances that are transferred from place of storage to end user through a piping system. In the case of anhydrous ammonia, it is directly pumped from the rail tanker into the bulk storage tanks as a gas and from there it is pumped to Final Product Recovery. In order to ensure health, safety and environment compliance a colour coding system has been introduced to indicate and separate hazardous material (acid, ammonium and diesel) from each other during the transfer process. Therefore, all the acid pipelines are painted purple, all ammonium pipelines are painted orange and all diesel pipelines are painted brown. Central Processing Control (CPC) actively monitors all major pipelines for leaks and spills by means of an automatic sensors and alarm system. It is also a requirement at Rössing to visually check pipelines, pumps, valves and tanks for leaks and spills and/or for structural integrity on a daily basis by the responsible owners.

- **Control measures**

Dangerous goods and hazardous substances that are required to be stored in bunded areas stored immediately in the correct manner. Hazardous substances storage containers (including gas cylinders) that are unsafe e.g. damaged, leaking etc, should be clearly marked as 'unsafe' to prevent them from being inadvertently used. All hydrocarbons on site will be stored in a bunded area other than temporary storage.

Bunding complies with Rio Tinto Environmental Standards and local legislation. Above ground tanks, drum storage facilities and pipelines that contain hazardous substances have a secondary containment mechanism. Assistance with detail on bunding requirements is available from the Environment Management Section of the HSE Department.

All hazardous substances containers on site will be labelled correctly, to include:

- Trade name of the substance;
- Possible harmful effects of the substance; and
- How to use the substance correctly.

Where a substance is decanted at work, the type of labelling required will depend on whether the substance is used immediately or over a longer period of time. Where a decanted substance is not used immediately, the employee shall ensure that the container into which the substance is decanted is labelled with the product name and the risk and safety phrases in accordance with the MSDS.

If an employee finds a container that does not have a label, this should be reported and corrected immediately.

The labels on containers are often the first point where people get information about the substances that they are to use. Usually these labels show whether the substance contained is hazardous. This however should be checked against the MSDS for the product.

TRANSPORT, EMERGENCY AND SECURITY

All dangerous goods and hazardous substances are delivered to site or removed from site by a transport company, driver and vehicle with the appropriate licenses and permits. Transport of dangerous goods are carried out in full compliance with all legislative requirements and transport vehicles marked and carry documentation, as required by legislation.

All transport carriers complete a site induction or be escorted by an inducted person when accessing the mine site.

Any dangerous or suspected contact with a hazardous substance will be communicated to a team leader as soon as possible. First aid details and emergency procedures are often detailed on MSDS's, and should be followed.

Should a spill clean-up be required for a task which includes the use of hazardous substances or for the ongoing storage of such materials, it is identified in Standard Operating Procedures s and should be in a state of readiness throughout the entire period of use or storage.

NOISE AND VIBRATION CONTROL

At Rössing, noise and vibration control is divided into two codes of practices i.e. hearing conservation and human vibration protection.

HEARING CONSERVATION

The purpose for this hearing conservation programme is to lay down a set protocol as to how potential noise sources should be identified, managed and controlled in order to prevent and/or reduce occupational noise exposure. This hearing conservation programme applies to all personal and area noise exposures in the workplace. It includes noise hazard identification, evaluation and the management of associated risks in order to ensure that employees, contractors and visitors will not suffer adverse health effects from noise generated by the mine operations.

HUMAN VIBRATION PROTECTION

Human vibration is a physical health hazard that is categorized according to the effect it has on specific human body parts which in turn depends on the type of job and equipment or tool being used during a work shift. Continued, habitual use of vibrating hand tools and equipment are connected with various patterns of disease outcomes. Protecting the workers and contractors against the possible risks arising from exposure to mechanical vibration is achieved by setting the minimum requirements, monitoring for compliance and instituting programmes to reduce exposures where required.

AIM

To decrease and manage risk from all mining operations and related activities, on and off site and including contractors, in terms of human health and the environment by:

1. Identifying, assessing and prioritizing sources of noise and vibration (worst case / impulse and normal operating conditions) according to impact significance;
2. Designing and implementing appropriate measures to control and manage negative impacts; and
3. Monitoring noise and vibration levels to ensure that Rio Tinto (based on internationally accepted criteria and adopting the most conservative), ISO and regulatory, standards are met.
4. Striving to accommodate the expectations of surrounding communities.

STRATEGY

1. Keep records of baseline noise and vibration levels (i.e. from other sources when no mining activity is occurring), as well as noise and vibration levels for existing mining operations. Maintain records of weather characteristics affecting noise and vibration propagation and noteworthy external sources of noise and vibration close to facilities.
2. Identify and characterise all activities that generate significant noise and vibration, and understand how differing weather and operational conditions affect the generated levels and propagation.
3. Identify, assess and prioritise all public health and environmental risks associated with exposure to individual and combined noise and vibration generation.
4. Identify environmental risk and management procedures for new developments, or substantive changes to existing facilities, to manage adverse impacts on the near and the far field noise and vibration levels. Predictive modelling will be used where necessary.
5. Develop internal criteria on required noise and vibration levels when government regulations are absent or incomplete, to ensure internationally accepted regulations and guidelines are met and to ensure the protection of public health and the environment.
6. Demonstrate that noise and vibration levels under normal and worst case (impulse) conditions (current or after changes) comply with Rio Tinto internal, ISO and regulatory, standards.

RISK

1. Public health impacts: physiological and psychological changes, e.g. hearing loss, stress, headaches.
2. Socio-economic impacts: changes in societal behaviour/matrix due to persistent noise / vibration, e.g. change in settlement areas and movement corridors of communities to adapt to disturbance, tourism and economic impacts.
3. Impact on fauna (including aquatic and birds): physiological and behavioural changes, e.g. change territory boundaries due to disturbance
4. Physical damage to environment: trees, landscape and geology.
5. Physical damage to built infrastructure: roads, buildings.

MANAGEMENT OF RISK

1. Develop and Implement a hierarchy of noise and vibration controls for each significant source of noise and vibration, with engineering or design controls being the first option adopted (i.e. pre-emptive solution). Only if for safety reasons these documented controls are not possible, then other measures are considered.
2. Incorporate control requirements into design and operational criteria for relevant exploration and mining activities, including drilling and blasting, processing and new facilities, and ensure that these requirements are maintained, e.g. location of new facilities to ensure generous buffer areas, use of natural topography and/or constructed or natural screens as noise dampers.
3. Incorporate noise and vibration performance criteria into purchasing requirements for relevant new equipment and machinery (by for e.g. including silencers/mufflers).
4. Maintain equipment and machinery in good working order to keep noise and vibration within acceptable levels, e.g. vehicle maintenance and servicing as per supplier specifications.
5. Adhere to acceptable operating hours, i.e. avoid or minimize noise-generating activities at night, over weekends and public holidays.
6. Timing of impulse noise activities such as blasting and drilling to coincide with conditions that are not conducive to the propagation of noise and vibration that is generated.

MONITORING

1. Implement a monitoring programme to measure identified parameters at regular intervals to ensure that standards are being met and to identify where corrective action is required and how effective existing management measures are.
2. Monitor noise and vibration levels outside the mining area, and at sensitive receptors such as nearby communities, on a regular basis and for impulse incidents such as blasts, to ensure levels remain with the acceptable range. These measurements are taken through a broad range of operating and weather conditions.
3. Analyse results (compare against baseline measurements) – implement changes if required to manage areas of concern arising from monitoring.
4. Ground vibration and air blast guidelines for blasting operations from the Rio Tinto Noise and Vibration Standards are: *"overpressure shall not exceed 120dBL for any blast and shall not exceed 115dBL for more than 5% of blasting during a year" and "vibration shall not exceed 10mm/sec for any blast and shall not exceed 5mm/sec for more than 5% of blasting during a year".*
5. Ensure emergency preparedness and response procedures to respond to abnormal noise and vibration conditions, with measures to protect public and environmental health.

Figure 8 summarises the information provided above.

MINERAL WASTE MANAGEMENT

Mineral waste is defined to include: waste rock and overburden, tailings and spent heap leach ore from mineral processing, rock masses disturbed by block caving, rejects from beneficiation or concentration of coal and other minerals, bauxite residue from alumina production, dross, refinery discards and sludges, smelter and other furnace slags, ashes, water treatment sludges, dredging materials and soils contaminated by mineral waste. At Rössing the mineral wastes are currently identified as waste rock and overburden and tailings.

AIM

1. To decrease and manage risk from operations in terms of human health and the environment.
2. Identify and assess risks (worst case and normal operating conditions).
3. Implement measures to control and manage negative impacts of mineral waste disposal.
4. Monitor pollutants to ensure that Rio Tinto & international standards are met.

STRATEGY

WASTE ROCK

A practical Waste Rock Disposal Planning and Design Strategy has been set up at Rössing Uranium. This strategy is used to ensure that in future waste rock dumps and low grade stockpiles are designed and constructed to the end of mine life with the aim of achieving a stable and economical placement of materials that incorporates drainage and structural considerations to progressively meet the final landform requirements and minimise significant reshaping at the end of mine life.

The objective of this strategy is to describe the procedure that was followed to design and expand the existing dumps taking into consideration economic, health, safety, environmental and practical aspects. In doing so the mining operation becomes aware and responsive to the economic and environmental implications surrounding waste dumping in the sensitive area in which Rössing's pit and disposal dumps are located. Mine planning considerations encompass aspects of the waste rock disposal plan that relate to materials handling and mine scheduling. Hauling cost, scheduling flexibility and a geotechnically sound dump design drive initial dump site selection from a mine planning perspective.

The waste disposal site selection and design constituted an iterative process where possible site and design concepts were developed, evaluated and compared, and the optimum site and design concept chosen taking the following constraining factors into consideration:

- Potential future pit limits (at higher metal prices). Infrastructure such as the mobile equipment workshop and primary crusher to the north.
- Visual impact constraints from the national road to the north of the mine, Welwitschia Plain and the Chert Quarry.
- Location of known radiometric anomalies i.e. geological features known as SH in the west and SK and RB in the east of the mine area.
- Khan River to the south.
- Stable landform configuration guidelines.
- Rössing Uranium Limited guidance on land management and use.
- Biodiversity and water management considerations.
- Minimising the dump footprint over undisturbed terrain.

Rio Tinto has a number of standards to which waste rock dump and low grade stockpile designs adhere to and together with Rössing Uranium's site specific procedures and local legislation a thorough study of these standards, procedures, guidelines and law was conducted, in order to develop a compliant set of waste rock dump and low grade stockpile designs. A thorough literature survey was the starting point in the development of the said waste disposal strategy.

TAILINGS

A tailings dam management plan and operation manual has been set up which describes the operating procedures for the safe and efficient management and control of the tailings disposal facility. This is to ensure that:

- The tailings dam is operated within the design parameters specified by Rössing and its consultants for the design of the facility.
- The tailings dam is operated and monitored to achieve the design objectives.

Compliance Criteria for tailings

The operation of the tailings dam has to comply with a number of conditions enumerated in the mine's domestic and industrial effluent discharge permit issued by the Department of Water Affairs (DWA). The most important conditions applicable to the tailings dam are:

- Tailings slurry should be disposed of in the tailings dam and the tailings solution are be recycled.
- All seepage from any effluent disposal site observed on surface and suspected underground, are intercepted and recovered for re-use as far as reasonably practicable in the mining and metallurgical processes.
- Any change in process techniques with a bearing on the quality of wastes, effluents or water economy or change in supervision shall be reported to the DWA without delay.
- An accurate water balance record showing total consumption, fresh water input, water recovery from specific seepage control boreholes, abstraction from production boreholes, loss of water in the mining processes, water savings effected and the re-use of water from the tailings dam, seepage dam, mine pond, open pit and treated sewage shall be submitted to the DWA.

Namibia currently has no guidelines for tailings facilities. In accordance with Rio Tinto's principle of using international best practice applicable to the local situation, the South African Bureau of Standards "SABS Code of Practice 0286-1998 – Mine Residue" was used in the preparation of this plan. The Western Australian guidelines were used to fill gaps in the SABS Code of Practice.

Other compliance criteria were derived from the Rio Tinto environmental standard on mineral waste, Rio Tinto and Rössing safety standards, the HSE policy and the environmental management system according to ISO14001.

RISK

1. Safety risk due to slope failure of waste rock dumps and tailings facility. High rainfall in the mine's catchment area could result in flash floods which in turn could cause soil erosion;
2. Acid Rock Drainage (ARD);
3. Contamination of waterways through seepage of solution containing dissolved chemicals;
4. Radiation exposure:
   - External exposure from working on the waste dumps or tailings dam (slightly higher than background levels);
   - Internal exposure from the inhalation of dust or radon and its daughters (both on and off the facilities);
5. Dust exposure;
6. Loss of flora and fauna if foot print is increased; and
7. Visual impacts, waste rock dumps and tailings dam can be seen from the national road or from the Khan River.

MANAGEMENT OF RISK

- **Slope failure**

The current waste dumps have been constructed by tipping over the crests with haul trucks to form lifts of up to approximately 60m in height. The foundations underlying the dumps are relatively stable and are either placed on rock outcrops or the dry gravel sands of the gorges.

With the exception of a small proportion of amphibolite schists, the rock dump materials are competent and erosion resistant. It is thus anticipated that the waste dumps will remain relatively stable in the long term with minor slope creep over an extended period of time. Potential environmental impacts resulting from individual batter failure of the dumps will be minimal due to the presence of wide catch berms. However, should multiple batter slope failure occur, there is a minor risk of sediment transportation downstream of the Dome Gorge.

- **Acid Rock drainage**

Leachates form in rock masses with sufficiently low permeability in areas of abundant rainfall and can result in acid rock drainage. However, the potential of the Rössing Uranium waste rock dumps to generate acid rock drainage is minimal due to the dry desert environment, the low sulphide content of the rock and the neutralisation capacity of the marble intermixed in the dumps.

The positioning of the dumps has altered the surface drainage patterns in the gorges with water directed either through or beneath the dump with the potential to increase the levels of heavy metals, salts and radio nuclides contributed to the groundwater. Primary and secondary aquifers play an important role in transmitting groundwater to the Khan River. The primary aquifers are the gorges that drain into the Khan River and the river itself which is filled with 10m to 20m of alluvial sand, the water level within the river bed is generally 2m to 3m beneath the ground surface. The secondary aquifers consist of rock of different geological formations weathered on structural features like fractures and joints. Water moves slowly through these secondary features down-gradient, with velocities and volumes of flow being much smaller than in the sand fill of the gorges, but showing a wide range of variability depending on rock type.

- **Groundwater contamination**

The seepage control systems in place prevent the spreading of nitrates originating from the blasting process, as well as natural sulphates and uranium will initially occur during rainfall. High volumes of surface water with very low salt concentrations will be created during this process. The non-polluting principle calls for the prevention of this water from entering the groundwater of the Khan River by maintaining the existing pumping systems.

The slurry being disposed of at the tailings dam is acidic when deposited, but neutralises as solution perculates through the tailings dam. Resulting higher concentrated solutions could lead to contamination of groundwater. To combat this, recycling of the tailings solution and a seepage control system has been put in place.

- **Dust Suppression**

The tailings roads are treated with chemical binder to prevent re-suspension of dust through vehicular movement. Windrows are created from tailings material around the tailings dam to contain wind erosion. Other dust suppression management include the management of stock piles, fit air conditioning in all cabins of mobile heavy equipment and dust monitoring to ensure compliance to dust standards.

- **Radiation**

Employees receives training in radiation protection and are provided with personal protective equipment e.g. respirators, overalls, gloves etc. Monitoring of external radiation, radon emission rates, dust concentration levels (both personal and the environment) is done. In addition, radionuclide concentrations in dust and ground water is monitored. Radiation exposure assessments are done for workers and the public to ensure compliance to set international standards.

- **Biodiversity**

Rio Tinto's Biodiversity Strategy commits the company to integrating the identification, evaluation and management of biodiversity issues throughout the business cycle. Of particular relevance to closure is the objective of achieving a net positive effect on biodiversity through minimising negative impacts and contributing to conservation. Because of the destructive nature of waste rock dumps and stockpiles the site selection and design were adhered to the guidelines as determined by the biodiversity specialist.
Rio Tinto's Waste Position Statement clearly states that limiting the waste footprint is one of their main priorities. Rössing Uranium conducted an extensive study in order to establish suitable areas where waste rock can be dumped. These areas were used as a starting point in order to define possible dump footprints. The goal was not to disturb any additional footprint i.e. waste rock dumps and stockpiles were constructed as far as possible over existing dumps and stockpiles and only veered off these existing dump footprints if the design was impractical.

- **Archaeology**

Any archaeological sites within a proposed disposal site have to be documented and the cultural significance evaluated. There are several finds with archaeological significance within the Rössing Uranium mine licence area. None of these areas were disturbed by dumping and stockpiling.

- **Visual impacts**

Because Rössing Uranium is situated in an area where tourism plays an active role in the economy the visual impact of the waste rock dumps and low grade stockpiles is kept at a minimum. Rössing Uranium placed a constraint on the maximum height of the dumps and stockpiles, not to be visible from the Khan River and a significant archaeological site.

The aim was to adhere to the said visual constraints, however, in order to minimise the dump footprint and because of the natural landscape it was not always possible to remain within these constraints. The dump design strategy features contouring benches in such a way as to create a sense of depth. The result is that the uniform lines are broken and the dump shape now blends into the surrounding landscape and is also a continuation of the dominant landscape features created by the geological feature of the Rössing Dome. This was an iterative process until the most suitable design match was produced from a cost and mining engineering perspective and also minimising the visual impact on the scenery from these two tourist viewpoints.

The information above is summarised in Figure 9.

NON-MINERAL WASTE MANAGEMENT

AIM

The objectives of the development and implementation of a Waste Management Strategy at Rössing may be summarised as follows:

- To develop protocols to responsibly manage and dispose of future waste arising according to their volume, potential impact on the environment, and safety requirements. This will encompass:
  - Refinement of current operating methods;
  - Waste collection;
  - Waste site development; and
  - Waste site management.
- To develop a mass balance of all waste-producing substances to ensure that the substance and its waste products can be fully accounted for at each stage of utilisation of the substance.
- To develop a full cost accounting base for all waste producing substances. This should include estimates of the environmental costs associated with the substance with particular reference to management of the waste products.
- To develop strategies to reduce, recycle and treat future wastes so as to ease the problem of waste disposal.
- To develop a programme of remediation to isolate and rehabilitate existing waste sites.
- To incorporate waste management, waste reduction strategies and waste site remediation into the proposed Environmental Management System to be established on the mine. To this end recommendations on the resourcing, monitoring and auditing stages of the EMS process as well as appropriate documentation and reports should be produced.

WASTE MANAGEMENT STRATEGY

The Rössing Waste Management Strategy has been developed and will be implemented with the objective of ensuring compliance with the Rössing Policy Statement on Health, Safety and the Environment which commits the mine to:

- Complying with appropriate health, safety and environmental legislation, taking due note of Article 95 of the Namibian Constitution and adhering to the best contemporary practice of the uranium mining and processing industry elsewhere;
- Striving to minimise the impact on the environment in the widest context, by adopting the principle of best contemporary practice during its operation and after de-commissioning; and
- Limiting Company exposure to environmental risk by identifying, controlling and monitoring environmental impacts on a regular, systematic basis.

The waste management strategy is based upon the accepted principles of waste reduction at source and recycling and reuse wherever possible. Disposal of waste to a landfill is carried out only where no economically viable alternative exists. All landfill sites designed and operated at Rössing Mine are adhering to the Minimum Requirements for Waste Disposal by Landfill as well as the Minimum Requirements for Monitoring at Waste Management Facilities as published by the South African Department of Water Affairs and Forestry (DWAF) 2nd Edition 1998.

NON-MINERAL WASTE MANAGEMENT PLAN

The Non-Mineral Waste Management Plan aims to ensure that regulatory and internal requirements have been addressed as well as to minimise the environment, safety and health hazards associated with the handling, storage and disposal of the variety of waste products generated by activities/products/services at Rössing. The waste management hierarchy of eliminate, reduce, reuse, recycle and dispose was followed throughout the write up of the waste management plan.

This waste management plan outlines how and what Rössing is doing and has done to reduce the amount of pollution and reduce the generation of waste. Goals for pollution prevention are measured by compliance with the established operating permits and Rio Tinto standard requirements. When new waste types are generated, new disposal options for these wastes types will be researched and included in the plan. The document will be updated as the need arises. The procedure aims to identify all waste streams and to indicate disposal requirements and finally to outline record keeping requirements.

This document addresses the requirements of the Rio Tinto Environmental Standards and addressing in particular the requirements of the Non-Mineral Waste Management Standard.

DEFINITIONS

- **General Waste (Non-mineral Waste):** This management plan will address all non-mineral wastes generated at the Rössing during the operational as well as decommissioning phases of the mine. The Rössing Audit Framework on Solid Waste Management defines General Wastes as: General waste is a generic term applied to all urban waste that is produced within the domain of local authorities. It comprises rubble, garden, domestic, commercial and general dry industrial waste. It may also contain small quantities of hazardous substances dispersed within it, for example, batteries, insecticides on domestic and commercial premises. General waste may be disposed of on any permitted landfill. However, certain general waste sites should have leachate management systems, since general waste can produce potential leachates. This is the result of waste decomposition, together with the infiltration and/or percolation of water.

- **Waste:** Described in the draft Pollution Control and Waste Management Bill as '*an undesirable or superfluous by-product, emission, or residue of any process or activity that has been discarded, accumulated or been stored for the purpose of discarding or processing. Waste products may be gaseous, liquid, solid or any combination thereof. Waste may originate from domestic, commercial or industrial activities, and include sewage sludge, radioactive waste, building rubble, as well as mining, metallurgical and power generation waste*'.

- **Hazardous waste:** Refers to waste composed of hazardous substances defined in the draft Pollution Control and Waste Management Bill as '*any pesticide, herbicide or other biocide, radioactive substance, chemical or other substance and any micro-organism or energy form that has properties that, either by themselves, or in combination with any other thing, make it hazardous to human health or safety, or to the environment, and includes any substance, micro-organism or energy form defined as a hazardous substance in (future) regulations'*.

REGULATORY REQUIREMENTS

Currently at least eight government ministries deal with waste management and pollution control:

- Ministry of Environment and Tourism (MET);
- Ministry of Health and Social Services (MHSS);
- Ministry of Agriculture, Water and Rural Development (MAWRD);
- Ministry of Works, Transport and Communications (MWTC);
- Ministry of Mines and Energy (MME);
- Ministry of Trade and Industry (MTI);
- Ministry of Regional and Local Government and Housing (MRLGH); and
- Ministry of Fisheries and Marine Resources (MFMR).

Due to this fragmentation there is a lack of clarity as to which legislation applies and which ministry or agency is responsible for particular issues. The draft Pollution Control and Waste Management Bill is designed to address these existing deficiencies and consolidate the legal framework while addressing related institutional fragmentation.

PLANNING

RISK ASSESSMENT

During the planning phase consultants were requested to do a survey of all the waste streams in order to characterize the environmental hazards and risks associated with non-mineral waste generated and disposed off site. The focus of the survey was to classify all waste being deposited on the landfill site according to:

- The types and quantities of waste being disposed of at the landfill site;
- The origin of the wastes and the method of transportation to the site; and
- The quantities of hazardous and recyclable wastes being landfilled.

A follow up survey was done to improve on existing statistics and to be in line with the expansion of the mine.

WASTE INVENTORY

The need for a documented inventory of waste generated and disposed of on or offsite was identified during the survey carried out by the consultant. This inventory was subsequently instituted and a document kept and reviewed by the Environmental Management section.

IMPLEMENTATION AND OPERATION

SAFE STORAGE

Waste Material Bins are used for the storage and handling of all waste materials and are located at the source of generation e.g. workshops, stores and offices. These bins are categorized and color coded as follows:

- Domestic Waste **(YELLOW);**
- Contaminated Waste **(WHITE);**
- Scrap Metal **(GREEN);**
- Hydrocarbon Contaminated Waste (oil filters/pipes) (**BROWN**);
- Salvageable Waste (cardboard) (**YELLOW CAGES**);
- Paper (recycle boxes);
- Oil (contained in leak proof 210ℓ containers temporary stored in bunded access controlled area for dispatch to recycling company); and
- Greases (contained in leak proof 210ℓ containers temporary stored in bunded access controlled area for dispatch to hazardous waste site).

In addition to color coding, signage is displayed on all bins specifying the type of waste that may be disposed of inside the bin.

PROCEDURES

Documented and operational waste management procedures were written up and communicated to the relevant role players.

WASTE DISPOSAL

Records of waste send to the landfill site as well as waste sent off site for recycling are documented and maintained Certificates of Safe Disposal for all hazardous wastes are forwarded to the Environmental

Coordinator for filing. Monthly records (in tonnes) of the total domestic, recycled and contaminated waste removed are updated by the Environmental Coordinator.

TRAINING

Training on waste disposal requirements and procedures are addressed through induction of all new employees and yearly refresher training.

ROLES AND RESPONSIBILITIES

Roles and responsibilities for effectively maintaining waste management on site are as follows:

- **Managers and Superintendents**

Have the responsibility to ensure that:
- All wastes generated in their sections or workshops are classified according to the direction given in the Waste Management Plan;
- All wastes are disposed of in the correct manner as indicated in the Waste Management Plan; and
- The classification of all wastes which are not specified in the standard Rio Tinto classification is referred to the Superintendent Environmental Management for a decision regarding classification and disposal.

- **Superintendent: Environmental Management**

Has the responsibility to ensure that:
- All wastes referred by the plant managers for classification are classified and directives are issued for the safe and environmentally responsible disposal of these waste materials;
- Impact Assessments are performed with regard to internal waste disposal sites as and when required; and
- All landfill and external recycle sites are audited on a two yearly cycle.

- **Superintendent: Workshops**

Has the responsibility to ensure that:
- New disposal sites are licensed in accordance with the relevant legislation;
- A permanent demarcated holding area for non-compressible waste material is provided;
- Adequate resources are provided to ensure that the non-compressible waste material disposal site are maintained in such a way that the sites comply with all legislative requirements (environmental, safety and health); and
- Supply the necessary equipment to compress/shred 20ℓ plastic and metal containers to prevent sale or use by third parties.

- **First Line Manager (FLM) Mobile Equipment**

Has the responsibility to ensure that:
- Salvageable waste and non-compressible waste bins within the Mine Site are regularly removed, emptied and replaced (“the service”);
- The service frequency is such that bins are emptied before they become overfilled;
- The mobile equipment drivers under his control are conversant with the waste materials permitted in the various bins, do not remove bins that contain non-permissible waste, and inform the relevant plant/workshop FLM when there is a problem with the contents of a bin;
- Domestic rubbish and contaminated waste bins are weight before disposal;
- Problems with the service as reported to him are investigated and corrected and, where possible, additional service is provided if requested;

- Access to the Waste Disposal Site is controlled;
- A record of the total mass of domestic rubbish and contaminated waste removed is send to the Environmental. Coordinator at the end of each month; and
- Maintain color coding and condition of bins according to standards.

- **First Level Managers**

Have the responsibility to ensure that:

- All personnel in their specific sections/workshops are fully trained with the departmental waste management system;
- All sorting of waste material is carried out at source prior to removal;
- Waste holding areas for their areas of responsibility are identified and demarcated;
- The holding areas are provided with adequate access for removal vehicles;
- The holding areas remain unobstructed at all times and have a suitable surface to facilitate cleaning;
- Appropriate signage is provided to ensure that waste collection and storage facilities are easily and correctly identified;
- Waste collection and storage facilities are maintained in an acceptable state with respect to mechanics and hygiene;
- All waste material is reduced to a size that will allow it to be placed in the storage facilities provided. If this is not practical the section/workshop FLM makes alternative arrangements for disposal;
- Waste 20ℓ plastic and metal containers are holed to prevent unauthorized use; and
- Used grease and oil are contained and dispatch to storage area as per procedure.

- **Manager Waste Management Contractor**

Has the responsibility to ensure that:

- Adequate resources are provided to ensure that the salvageable waste material holding is maintained in such a way that the sites comply with all legislative requirements (environmental, safety and health);
- A radiation clearance is obtained before compressible and salvageable waste as well as scrap metal is removed by the contractor from site;
- All empty 210ℓ drums are removed to the temporary storage yard;
- A monthly record of all scrap metal send of site is send to the Environmental Coordinator at the end of the month; and
- Waste 20 l plastic and metal containers are holed to prevent unauthorised use.

- **Environmental Coordinator**

Has the responsibility to ensure that:

- Records and certificates of wastes generated, stored and hydrocarbons disposed of are filed and maintained;
- Groundwater monitoring in the vicinity of the internal landfill sites is implemented as and where required;
- Landfill and hazardous waste sites are inspected on an ad hoc basis and records of these inspections are kept; and
- All landfill and external recycle sites are audited on a two yearly cycle.

- **Water Specialist**

Has the responsibility to ensure that:

- Groundwater monitoring below the landfill site is carried out as per monitoring schedule and results reported;
- The necessary contingency plans are in place during abnormal events; and

– The necessary steps are taken when water quality sample results do not meet the required standards.

- **Superintendent: Protection Services**

  Has the responsibility to ensure that:
  – Access control to the landfill site as well as the contaminated waste disposal site is strictly adhered to; and
  – The availability of a Protection Services employee (to prevent unlawful removal of material) at all times when scrap or recyclable materials are being loaded.

TREATMENT OF WASTE

- **Contaminated waste**

  Contaminated waste (any redundant item of which the total of fixed and non-fixed radioactivity is >0.4Bq/cm^2 - averaged over 300cm^2) should be disposed of in the white luggerbins. This waste is disposed of at the contaminated waste site on the Tailings Dam every Wednesday.

- **Tyres**

  Redundant tyres from pit equipment that cannot be sold may be dumped at the designated disposal site. These tyres will eventually be covered by waste rock when current site is filled to capacity. This process are controlled by the Superintendent Load and Haul to ensure these redundant tyres are covered. Tyres from light and heavy vehicles that can be re-treaded are removed by a tyre supplier. The side walls of redundant tyres are cut to prevent further use and disposed of in the same manner as pit equipment tyres.

- **Fluorescent tubes**

  All scrap fluorescent tubes are crushed and stored in a sealed receptacle at Plant Electrical. Once the container is full it is sealed, clearly marked and taken to the temporary storage yard by Plant Electrical.

- **Redundant chemicals**

  Redundant chemicals are disposed of in clearly labelled sealed drums. These drums are taken to the hydrocarbon supplier used oil storage yard from where it is taken offsite to the Walvis Bay Hazardous Waste site.

- **Batteries**

  Redundant batteries (12V and 24V) are stored in an area properly demarcated and in such a way that no soil contamination occurs. The stored batteries are collected by contractors on request and dispatched to a recycler in Windhoek.

- **Used grease**

  Used or waste grease is collected and stored in clearly marked sealed 210ℓ drums. Each area owner ensures that the sealed, cleaned drums are sent to the hydrocarbon supplier used oil storage yard. The use grease is sent to the Walvis Bay Municipality Hazardous Waste Site. Permits for safe disposal are supplied to the Environmental section by hydrocarbon supplier for safe keeping. Protection Services also supplies the Environmental section with a copy of the dispatch advice and Supply Chain the weight of the dispatched oil.

- **Oil contaminated rags and PPEs**

  Oil rags and other oil contaminated personal protecting equipment (PPEs) are disposed of in 210ℓ drums. When these drums are full they are sealed and clearly labelled before taken to the hydrocarbon supplier used oil storage yard. These drums will be removed from site by the contractor for disposal at the Walvis Bay Hazardous Waste site.

- **Paper and Cardboard**

  Paper is deposited in recycling boxes located inside each office block. When the boxes are full they can be emptied into a plastic bag and stored in the cage at the contractors yard.

  Card board boxes are flattened and disposed of into the wire cages located outside some office areas and the workshops. The paper and cardboard are removed by a contractor from site for recycling. Records of volumes removed are supplied by the contractor to the Environmental Department for filing.

- **Wood**

  Waste wood, (broken pallets, timber off-cuts, packing material) can be recycled by placing it near or next to the wire cages. The wood is removed by a contractor from site for recycling.

- **Scrap steel**

  All uncontaminated steel is placed in green luggerbins for recycling by the contractor. Total recycled material dispatched during the month is reported to the Environmental section by the contractor.

- **Used oil**

  Used oil is stored in sealed 210ℓ drums in bunded areas. Each area owner ensures that the oil is first tested by the HEF plant staff to determine whether it can be re-used in the manufacturing of explosives. The area owner ensures that only the rejected used oil is send to the used oil storage yard. This oil is then sent to a company in Walvis Bay for recycling. Permits for the safe disposal will be supplied to the Environmental section by the supplier for safe keeping. Protection Services also supply the Environmental section with a copy of the dispatch advice and the weight of the dispatched oil.

- **Plastic containers**

  Empty 5, 10, 20 and 25 litre oil plastic containers are properly stacked next to yellow cage for eventual removal by the contractor. However these plastic containers should be holed before they are taken off site.

- **Oil filters**

  Oil filters are drained at area of source for 24 hours before they are stored in 210ℓ drums in the work area until the drums are full. When a drum is full it should be sealed and clearly labelled before it is taken to the used oil storage yard.

- **Air filters**

  Air filters are disposed of in the yellow luggerbins.

- **Metal drums**

Empty 5, 10, 20 25 and 50 litre metal drums are taken to the used oil storage yard for crushing (empty grease drums are properly cleaned prior to disposal). The drums are crushed and taken offsite for recycling by the contractor.

- **Hydraulic pipes**

All hydraulic pipes are drained and cut up into smaller pieces at area of source before they are stored in a 210ℓ drum. When the drum is full it is sealed and clearly marked before it is taken to the used oil storage yard. The hydraulic pipe pieces are taken offsite for recycling by the contractor.

- **Domestic waste**

All domestic waste (rubble, garden, domestic, commercial and general dry industrial waste) are disposed of in the yellow luggerbins. This waste is taken to Rössing Uranium's Landfill site for disposal by the Mobile Equipment Workshop. The total weights of the waste disposed of during the month are reported to the Environmental section by the Mobile Equipment FLM.

Figure 9 summarises the information provided above.

WORKER SAFETY

HEALTH & SAFETY

Rössing Uranium believes it is the right of every employee to work in a safe environment and the company will therefor ensure that incidents, which could result in injury and/or occupational disease to employee's and/or damage property, are eliminated or minimised.

Rössing Uranium realises that alcohol and/or other drug use can lead to major deficiencies in an individual's work performance and are seen as a contributing factor in industrial accidents. Abusive use of alcohol and drugs can also lead to serious disruption to healthy social, family, and community relationships. Since Rössing Uranium is committed to providing and maintaining a safe and healthy working environment for all its employees a zero tolerance approach regarding alcohol or other drugs is followed. The company takes every reasonable step to ensure that all individuals are free from alcohol and other drugs whilst at work in order not to compromise or threaten the safety or health of themselves or others.

Although many substances may present potential hazards to health, safety and the environment, these substances can still be used without unacceptable risks provided the hazards are understood and the appropriate standard procedures are followed. This is accomplished by:

- Assessment of health and safety risks;
- Prevention or control of exposure;
- Use of control measures and maintenance;
- Monitoring exposure at workplace;
- Health surveillance; and
- Information and training.

Health and safety remains a high priority within Rio Tinto and Rössing Uranium, and Rössing Uranium has ventured into the "Accelerating Safety Performance Improvement" (Zero Harm) project in order to foster a Zero Harm working environment in line with leading practices.

The goal is to achieve zero harm. It is believed that management and the workforce can together create an injury and illness-free workplace and that everyone goes home safely and healthy each day of their working life.

OCCUPATIONAL HYGIENE MANAGEMENT

Rössing Uranium has developed and implemented a risk-based occupational hygiene monitoring programme that is reviewed and updated annually based on prevailing and emerging identified health hazards and levels of risk. The monitoring programme is applied to similar exposure groups (SEGs). These groups include all current Rössing Uranium workers and site contractors. Typical hazards that are measured include, amongst others, noise, illumination, dust, hazardous substances, gases, vapours and fumes, legionella (a waterborne bacteria that can cause legionnaires disease) and radiation.

OCCUPATIONAL MEDICAL SURVEILLANCE

All employees and contractors undergo pre-employment medical examinations to ensure fitness to work. This is followed by regular risk-based medical examinations during employment and an exit-medical examination when leaving the company. The medical surveillance programme provides relevant information for the purpose of controlling the health risk and preventing, detecting and treating occupational diseases.

WELLNESS

Various activities are undertaken to support Rössing's lifestyle awareness programmes.

1. ***Be Active Challenge***: The Be Active Challenge aims to raise awareness of the importance of exercise for health and wellbeing by encouraging participants to walk, run, swim or cycle.
2. ***Peer Educator activities:*** Peer education is an essential tool in the fight against HIV/AIDS and promoting general healthy lifestyle and well-being amongst peers. It is based on evidence that information received from someone of the same group (co-workers, people of the same age or health status) is more easily accepted and trusted. Peer Educators serve their peers by acting as an easy accessible resource for questions and concerns about HIV/AIDS and other health matters.
3. ***Supporting events that promote health e.g. National Bandana Day and World Aids Day:*** Rössing Uranium supports these national and international initiatives. The Rössing Uranium tobacco smoke policy is one of partial non-smoking within the confines of all Rössing Uranium premises and will be designated into smoking and non-smoking areas.

SAFETY MANAGEMENT

Rössing Uranium applies risk management to current facilities and practices, new projects as well as changes in operating conditions, processes and management. An employee's abilities and competencies are assessed and developed before selection and job placement. Employees are trained in performing risk assessments. All personnel carry out informal risk assessments prior to performing their daily tasks and work accordingly.

The safety programme ensures that effective controls and safe work procedures are in place for all high-risk activities. All safety incidents are investigated to identify all the controllable causes so as to prevent any possible recurrence of any such incident.

Induction training is done for all employees, and contractors before commencement of any work at Rössing Uranium. No contractor is allowed entry on site without a valid safety induction certificate. This initial safety training is followed up by an annual refresher course.

Management ensures visibility in all areas to demonstrate their commitment to HSE by conducting personal interactions with employees and contractors at their place of work.

Regular audits are carried out to ensure that Rössing Uranium remains in compliance to health and safety standards and procedures and that HSE MS performance is maintained and/or improved. The health and safety management programme is summarised in Figure 10.

DISASTER MANAGEMENT AND RECOVERY

Rössing has a Disaster Management and Recovery Plan, which is activated when emergencies occur. At present the emergencies that are covered are discussed below, any other disasters that may occur will result in the Disaster Management & Recovery Plan being activated.

ANHYDROUS AMMONIA UNCONTROLLED LEAK

Anhydrous ammonia gives off harmful ammonia vapour which acts as an irritant to eyes, nasal passages and lungs and could prove fatal during prolonged exposure of sufficient quantity. Anhydrous ammonia, by virtue of its penetrating, intensely pungent odour, acts as its own warning signal. Consequently, there is no likelihood of anyone voluntarily remaining in an area where the concentration becomes hazardous.

Rössing Uranium's anhydrous ammonia storage plant is situated between the plant reagent store and the Final Product Recovery building. It is constructed with all the necessary safety precautions to minimize the chance of an uncontrolled ammonia release and to control the situation if a leak should occur.

On reviewing past experiences of ammonia emergencies throughout the world, two points are evident:

- In the event of an uncontrolled ammonia leak, a visible white gas cloud will form and move downwind following the contours of the ground; and
- Personnel who remain inside a closed building are considerably safer than those who venture outside.

This procedure caters for a large leak of ammonia originating from the ammonia storage plant, or from a rail tanker from anywhere between the ammonia storage plant and Arandis siding.

MULTI-CASUALTY ACCIDENT

A multi-casualty incident is defined as an incident that involves four or more serious casualties that require immediate treatment and eventual transport to an off-site hospital. A fatality is not considered a casualty in the context of this emergency procedure.

Emergency response teams are involved in a multi-casualty incident shall follow this procedure for an incident either on site or off site, e.g. a Rössing Uranium bus accident.

URANIUM OXIDE SPILLAGE

Rössing Uranium produces natural uranium ore concentrate (U_30_8), which is listed as a Class 7 hazardous material, with a United Nations hazardous material number of 2,912. The hazardous properties of U_30_8 are relatively low compared to other radioactive materials and most hazardous materials in general. However, the negative public perceptions associated with radioactive materials as a whole absolutely necessitates that any emergency involving these materials be handled quickly and efficiently.

Uranium oxide is transported to the company's customers in 210ℓ drums that are approved by the International Atomic Energy Agency (IAEA). To complete the packaging each drum is labelled with the required IAEA information on two sides. The drums are loaded into an ordinary shipping container that is hazard labelled on all four of its sides.

The consignment leaves Rössing Mine by rail to the port at Walvis Bay, which is a journey of about 90km. The consignment is then loaded onto a ship and transported to Cape Town or Durban Harbour. The consignment is offloaded at Cape Town or Durban harbours and then loaded onto a ship for onward transport to the overseas converters. It is important to note that the consignment remains the property of Rössing Uranium until the product is processed by the converter.

Formal and legal regulations are in place in the USA, Canada, UK and France to deal with a U_30_8 spill emergency in their countries that clearly addresses responsibility and accountability regarding emergency response and clean up. However, hazardous material regulations in South Africa and Namibia are less clear and certainly less understood. This has necessitated the company setting up formal procedures with Cape Town and Durban Port Authorities and city Emergency Services in South Africa, and Namrail and Namport in Namibia to assure the quick and efficient handling of a U_30_8 spill emergency.

FLOOD EMERGENCY

The flood emergency plan is solely concerned with the preservation of human life in the event of a flood condition arising out of a heavy rainfall. It should be emphasised that this plan is the only emergency action plan for flooding and should not be confused with the document "The 100 Year Flood Plan". The 100 year flood plan is a mitigating strategy to protect critical process plants by establishing permanent physical barriers to stop or deflect heavy floodwaters.

There is no central warning system in place to warn of an imminent flood situation. Environmental Management Section will keep abreast of heavy rain conditions in the country and put the mine on alert for possible flooding if warranted. However, it is the responsibility of the work area supervisors to action their areas emergency flood contingency plans. In any case, all employees know where to go to be safe from a flood situation without the need for last minute instructions.

Every work area on site has a written flood evacuation plan, which is situated in an area that is immediately accessible to the workers.

To assist the area supervisors, there is located at each work station a red file called the "Emergency Plan" file (red file). This file has a section on emergency actions in the event of a flood. These instructions are in general terms, but can be used to make an area specific plan. Also included in the red file is a plan diagram showing the flow of water on site in the event of a flood. This diagram will also assist you in formulating a plan as it shows the areas where the flood waters will flow the deepest and run the fastest.

FIRE EMERGENCY

The fire emergency procedure will be executed by the general mine public when an out-break fire occurs on site regardless of the size. Even if the personnel in the area have quickly extinguished a fire, Protection Services should still be called to check for possible fire extensions and to investigate the origin and cause.

FRESH WATER EMERGENCY PROCEDURE

This procedure is activated when the reservoir level approaches 2m (40% full). The person responsible for communication with NamWater and arrangements on site will be the Supt Tailings Dam and Water Management, or in his absence, the Supervisor Water Management. On back shifts the Supervisor Extraction will decide whether to contact NamWater him / herself or involve Water Management. In the former case the Supt Tailings Dam and Water Management has to be informed on the following day.

Information regarding the cause of the supply interruption and expected duration is obtained from NamWater and communicated as appropriate to assist in decisions on further action (e.g. monitoring, request for water saving or preparing for shutdown of the Plant).

At 1m (20% full) the Plant has to be stopped to ensure sufficient supply to consumers in Arandis. Drawdown of the reservoirs to this level should be avoided by timely intervention and communication with NamWater.

If the mine's telemetric system is off, the reservoir level and inflow has to be obtained from NamWater by phoning the control room. The Central Process Control Operator on shift phones every 2 hours and note the data in a logbook kept for this purpose. If the level indication does not work the Supt Tailings Dam and Water Management will request the Water Control Officer to measure the reservoir level with a dip-meter.

LAND USE STEWARDSHIP

RIO TINTO REQUIREMENT

Business principles of Rio Tinto stipulate the need for managing the land used by each of its operations based on land use zones, objectives, performance targets and action plans. Thus a Land-Use Stewardship Standard has been formulated which specifies a number of requirements. The intent of this standard is to ensure sustainable stewardship of the land which Rio Tinto owns, leases or manages. The stewardship requires an understanding of the current and potential ownership and use of the land, its value and community expectations followed by an integrated and strategic approach to land management that identifies and mitigates the impacts of mining operations.

UNDERSTANDING OF LAND OWNERSHIP

Much of the Namib Desert falls within state land. The Rössing Uranium tenement is situated within the Gaingu Conservancy area, which is un-surveyed communal state land. The current land under stewardship of Rössing Uranium covers an area of 18,141ha, while the mine complex covers an area of 2,165ha.

Five broad land tenure regimes are identified:

- Arandis Town and Townlands;
- Mining Licence Area 28;
- the Accessory Works Area;
- the Namib Naukluft Park; and
- Rössing Uranium immovable properties and rentals.

The land use issues of each land tenure regime, defined by mandatory obligation and legal framework, are identified accordingly. Various forms of legislation – concrete and inferred – are relevant to the management of land at Rössing Uranium. Legislation relevant to land ownership, tenure and land rights had been analysed and understood.

UNDERSTANDING OF ENVIRONMENT AND BIODIVERSITY

The climate around Rossing is described as hyper-arid and water is indeed scarce. Biota, as a result, is specialised and sensitive. Two plant species deserve special mentioning namely the cryptic rock plant *Lithops ruschiorum* and the succulent *Adenia pechuelii*, while several special animal species occur. There is a wealth of beetles and reptiles in the area. The biogeography of the mine was analysed in 2005 and four biotopes were rated as of high biodiversity value:

- The undulating granite hills;
- Drainage lines;
- Quartzite outcrops; and
- Marble-quartzite ridges.

With the promulgation of the Namibian National Heritage Act (Act No. 27 of 2004), Rössing Uranium had a heritage survey of the entire tenement done. The aim was to locate and assess features of significance that could be affected during exploration and future mining operations. Evidence for archaeological sites was obtained, and although there is some evidence of upper pleistocene occupation, most of the sites date to the last 5,000 years. Sites of historical importance were also identified, dating from the time of the narrow gauge railway that existed between the former Khan Mine and the Arandis siding. The archaeological site distribution falls largely outside the main focus of mining operations, meaning that it is unlikely that important archaeological sites were destroyed in the course of mining activity.

The location, extent and character of significant and natural features are pivotal considerations in the compilation of a land use management plan. Significant features encompass a wide variety of site-specific points as well as zonal areas, ranging from critical habitats or habitats occupied by threatened or endangered species to locations of heritage importance.

The Rössing Uranium tenement is not an area of outstanding archaeological importance, but definite steps are being taken to conserve the existing heritage and historical sites, in addition to prevent encroachment of mining activities onto these sites.

- **Area mapping**

  To zone the land uses for the purpose of an eventual land use management plan requires the accurate mapping of current mining operations and the zones currently affected by those operations. The major components of the land collectively described as the disturbed area include the open pit area, buildings around the open pit, waste rock dumps and ore stock piles, crushers and the ore transport system, the industrial complex of the processing plant, office buildings and workshops, contractor yards, storage facilities, the tailings dam and linear infrastructure. The disturbed area includes also parts such as the landfill area (non-mineral waste) and the sewage treatment plant. Undisturbed land, in general terms, comprises the land outside the disturbed part. Although labelled as undisturbed land, some legacy sites such as the former exploration boreholes, remains of former construction camps, former and current monitoring boreholes and former borrow pits are located here.

- **Land Use Zoning**

  To zone the land uses for the purpose of land use management it is essential to consider the extent of current mining operations and to describe the zones currently affected by those operations. Of particular interest is the demarcation of the footprint of mining operations – currently as well as proposed – land rehabilitated, contaminated sites, hydrological aspects and the location of areas of high biodiversity value, archaeological and historical sites.

- **Land Use Management Plan**

  A land use management plan is being set up based on the mitigation of its risks identified. These risks are related to the management of knowledge about the characteristics of the land and procedures to allow or refuse access to undisturbed areas for future development.

The above is summarised in Figure 11.

BASIC PROCESS DESCRIPTION OF CURRENT OPERATIONS

END

5 PRODUCT EXPORT: Final product is packed into drums, transported by rail to Port of Walvis Bay and exported by ship.

4 PROCESSING PLANT: Further crushing and grinding, leaching, slime separation, thickening, continuous ion exchange, solvent extraction, precipitation, filtration, drying and roasting of "yellow cake" to produce uranium oxide. Wet tailings waste is pumped to tailings storage facility.

3 PRIMARY CRUSHER: First stage of crushing the ore for processing – crushed ore is transferred by conveyor to coarse ore stockpile and on to processing plant.

2 RADIOMETRIC SCANNING: scanning of trucks to determine ore grade – acceptable grade transported to primary crusher, and remainder to waste rock dumps

1 OPEN PIT MINE: drilling, blasting and loading of blasted material

START

PRODUCT/WASTE	PROCESS OVERVIEW	IMPACTS AND MITIGATION/CONTROLS
Poor quality ore - road haul to low grade stockpile Higher quality ore - road haul to primary crushers Material with little or no uranium - road haul to waste dumps	***1 MINING*** Open cast mining for uranium is achieved through initial drilling and blasting of the ore body, with loading of material and removal (hauling) to identified stockpiles. The open pit is developed in a series of "benches" or levels, interconnected by a system of haul roads. Because minerals are distributed erratically in the ground, waste and ore are often mixed. Radiometric scanners are used to measure the radioactivity level of each truckload. Based on this, material is either sent to the primary crushers, to ore stock piles or waste dumps.	***Dust emissions:*** • To control dust in the open pit, a chemical binder is applied to the roads and brackish water is sprayed onto roads and muckpiles by means of water tankers and reticulated spray systems. • All drilling is carried out by wet means to keep dust levels and therefore radiation exposure as low as possible. • Machines are all fitted with air-conditioned cabins, with efficient air filtration to filter out radioactive dust particles. ***Noise:*** Vehicles are manufactured to ensure that noise levels are within exposure standard. Vehicle maintenance and noise monitoring ensure that noise levels remain within standard. ***Radiation:*** These cabins are also effective in minimising exposure to external radiation. Air-conditioners in cabins filter out radioactive dust particles resulting in reduced internal radiation exposure. ***GHG:*** Haul trucks are assisted by electricity to travel up haul roads (trolley assist) and this reduces the amount of diesel used and thus the greenhouse gas emissions.
Ore sent by conveyor to coarse ore stockpile Fine crushed ore sent by conveyor to fine ore stockpile	***2 CRUSHING CIRCUIT*** Haul trucks deliver ore to the primary crushers, which is then sent to the coarse ore stockpile by conveyor systems. The ore passes through a series of crushers and screens until particles are smaller than 19mm. The fine ore is then weighed and sent to the fine ore stockpile.	***Dust Emission:*** • Crushing circuit is equipped with an adequate system of dust extraction and collection. There are ten collection systems that provide extraction points from the reclaim tunnel to the fine ore storage bin. • Regular wash down of the plant reduces the amount of windblown dust. • A monitoring program ensures that regular area and personal dust monitoring is done and measured against annual targets. To demonstrate continuous improvement lower targets are set. • Workers are adequately protected by wearing respirators, allowing the standard of 0.5g/m³ of dust exposure to be maintained. ***Noise and vibration:*** The personal monitoring program ensures that workers are regularly monitored. Workers are adequately protected by wearing hearing protection. ***Radiation:*** Radiation exposure levels are low and thus measured on a representative sample of workers in the area. ***GHG:*** Pre-screening plant introduced to screen out finer material and thus reducing the need to send all material through the crushing circuit. Ore sorting is being refined for optimisation.
Return dam solution added to ore when grinding Spent grinding rods	***3 GRINDING*** The crushed ore is reduced to slurry by means of wet grinding by up to four rod mills, operating in parallel.	***Noise and vibration:*** Monitoring for noise done as required in the noise monitoring program. Workers wear hearing protection.
Sulfuric acid is brought from the Walvis Bay port to the mine by rail Waste: Contaminated plant equipment and structural parts.	***4 EXTRACTION PLANT / LEACHING PLANT*** A combined leaching and oxidation process takes place in large mechanically agitated tanks. The uranium content of the pulped ore is oxidised by ferric sulphate and dissolved in a sulfuric acid solution.	***Noise and vibration:*** Monitoring for noise done as required in the noise monitoring program. Workers wear hearing protection. ***Radiation:*** Radiation exposure levels are low and thus measured on a representative sample of workers in the area.
Washed coarse sand is sent to tailings dam by conveyor Waste: Contaminated plant equipment and structural parts	***5 PROCESS PLANT - Slime separation*** Cyclones are used to separate sand and slime in the pulp resulting from leaching. After washing the coarse sand in Rotoscoops to remove any traces of uranium-bearing solution, it is transported by a conveyor system to the tailings disposal area to mix with slimes before deposition.	***Noise and vibration:*** Monitoring for noise done as required in the noise monitoring program. Workers wear hearing protection. ***Radiation:*** Radiation exposure levels are low and thus measured on a representative sample of workers in the area. ***Dust Emission (only on tailings dam):*** • A windbreak system is employed by constructing the windrows from tailings material at the paddies. This assists in the reduction of dust generation during high velocity wind episodes. • Roads are sprayed with seepage water and binding chemicals to reduce windblown dust. • Workers are also protected by wearing respirators when dust is generated during high wind episodes.
Washed slime and tailings are pumped to the tailings dam Waste: Contaminated plant equipment and structural parts	***6 PROCESS PLANT - Thickening*** Counter-current decantation thickeners wash the slimes from the previous stages. A clear uranium-bearing solution ("pregnant" solution) overflows from the thickeners, while the washed slime is mixed with the sands and pumped to the tailings dam to recombine with the sands and the deposited in active paddies on the dam.	***Noise and vibration:*** Monitoring for noise done as required in the noise monitoring program. Workers wear hearing protection. ***Radiation:*** Radiation exposure levels are low and thus measured on a representative sample of workers in the area. ***Dust Emission (only on tailings dam):*** • A windbreak system is employed by constructing the windrows from tailings material at the paddies. This assists in the reduction of dust generation during high velocity wind episodes. • Roads are sprayed with seepage water and binding chemicals to reduce windblown dust. • Workers are also protected by wearing respirators when dust is generated during high wind episodes.
Waste: Contaminated plant equipment and structural parts	***7 PROCESS PLANT - Continuous Ion Exchange*** The clear pregnant solution is brought into contact with beads of specially formulated resin. Uranium ions are absorbed into the resin and are preferentially extracted from the solution. The "barren solution" is sent to the rotoscoops for washing sands. The loaded beads are removed periodically to elution columns where an acid wash removes the uranium from the beads. The resulting eluate is a purified and more concentrated solution.	***Radiation:*** • Regular descaling of the plant keeps the external radiation to an acceptable level. • Workers are designated as radiation exposed personnel and wear external radiation monitors which are analysed on a monthly basis. Annual cumulative exposure is followed to ensure that exposures remain below the standards. ***Noise and vibration:*** Monitoring for noise done as required in the noise monitoring program. Workers wear hearing protection.
Waste: Contaminated plant equipment and structural parts	***8 SOLVENT EXTRACTION PLANT*** The acidic eluate from the ion exchange plant is mixed with an organic solvent which takes up the uranium. In a second stage, the organic solution is mixed in a neutral aqueous ammonium sulphate solution which takes up the uranium and becomes the uranium-rich "OK liquor". The acidic solution after removal of the uranium "rafinate" is returned to the elution columns for recycling.	***General:*** All workers are required to complete induction training prior to being granted excess to work in the area. A refresher course must be completed to continue having excess. ***Radiation:*** Workers are designated as radiation exposed personnel and wear external radiation monitors which are analysed on a monthly basis. Annual cumulative exposure is followed to ensure that exposures remain below the standards. ***Gas emissions:*** Respirators to remove gases are supplied to workers. These are worn when working near areas where emissions are generated. ***Fire Hazard:*** • Extreme excess control in place to prevent fire. • No fire ignition products or any equipment that could cause a spark are allowed in the plant.. • Access is strictly controlled to only allow working staff. • Automatic fire extinguishing system is in place.
Waste: Contaminated plant equipment and structural parts	***9 PRODUCT RECOVERY PLANT - Precipitation*** The addition of anhydrous ammonia to the "OK liquor" raises the solution pH, causing ammonium diuranate to precipitate, which is then thickened to a yellow slurry.	***General:*** All workers are required to complete induction training prior to being granted excess to work in the area. A refresher course must be completed to continue having excess. ***Noise and vibration:*** Monitoring for noise done as required in the noise monitoring program. Workers wear hearing protection. ***Radiation:*** • Workers are adequately protected by wearing hearing protection and respirators. • Workers are designated as radiation exposed personnel and wear external radiation monitors. • Workers are designated as radiation exposed personnel and wear external radiation monitors which are analysed on a monthly basis. Annual cumulative exposure is followed to ensure that exposures remain below the standards.
Waste: Contaminated plant equipment and structural parts	***10 PRODUCT RECOVERY PLANT - Filtration*** The ammonium diurante is recovered on rotating drum filters as yellow paste, known as "yellow cake".	
Waste: Contaminated plant equipment and structural parts	***11 PRODUCT RECOVERY PLANT - Drying and Roasting*** Ammonia is driven off by final roasting, leaving uranium oxide (U_3O_8). The product s packed into metal drums. Neither ammonium diurante or uranium oxide is explosive.	***General:*** All workers are required to complete induction training prior to being granted excess to work in the area. A refresher course must be completed to continue having excess. ***Noise and vibration:*** Monitoring for noise done as required in the noise monitoring program. Workers wear hearing protection. ***GHG:*** Monitoring for greenhouse gas emissions are done on a monthly basis. ***Radiation:*** • Workers are designated as radiation exposed personnel and wear external radiation monitors which are analysed on a monthly basis. Annual cumulative exposure is followed to ensure that exposures remain below the standards. • The international transport regulations for radioactive material are strictly adhered to. • Clearance monitoring done on all personnel and equipment to ensure that no contaminated persons or material leave the product recovery plant. ***Uranium Dust Emissions:*** • Dust extraction system to remove dust generated. • Access control to limit entry for emergencies only. • Regular wash down to prevent re-suspension of dust. • Respirator program for emergency and normal operations. • Personal dust monitoring program for workers to ensure operation controls are efficient. ***Emissions from Stack:*** Total emissions are determined from annual stack monitoring and the level of production. The stacks are installed with scrubbers to reduce the release of these gases into the ambient air. These scrubbers are monitored annually.
Product containers are transported to Walvis Bay Port by rail and then shipped overseas	***12 PRODUCT RECOVERY PLANT - Loading and Dispatch*** 200ℓ drums are filled with U_3O_8. These are weighed and packed into shipping containers for overseas export.	

Independent companies convert the U_3O_8 into uranium hexafluoride. This is then sent to enrichment plants where the concentration of the isotope U235 is increased to levels required for nuclear reactors. The enriched uranium is converted in uranium dioxide, formed into skid cylindrical pellets, sealed in metal fuel rods and bundled into fuel assemblies, which are loaded into nuclear reactors for the generation of electricity.

Figure 2: Overview of Process and Mitigation

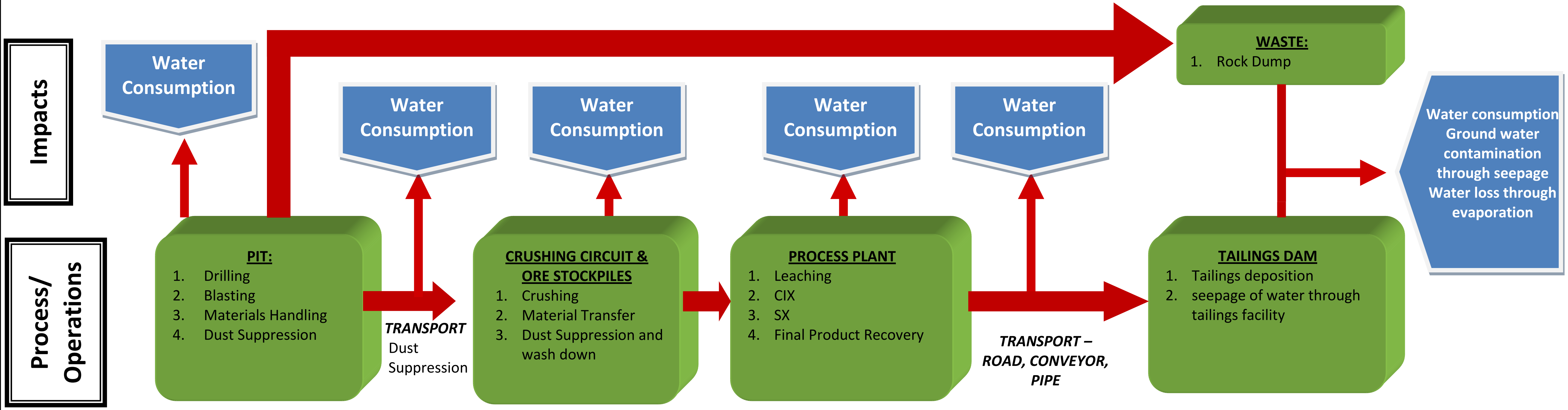
WATER MANAGEMENT

AIM:

1. Optimise water use efficiency.
2. Minimal adverse impact on natural water quality and water quantity.
3. Value of water considered in business decisions.
4. Awareness of community expectations associated with water.
5. Effective communication with internal and external water users to enhance sustainable water management.

STRATEGY:

1. Monitor legal requirements and group standards regularly in order to maintain full compliance with applicable legislative and group requirements.
2. Reduction in the use of water will be target driven.
3. Appropriate technologies, reuse and recycling of water will be applied to achieve the efficient use of water.
4. Pollution prevention shall be addressed by minimising emissions to groundwater through the use of seepage control systems and operating procedures.
5. Objectives and targets, which are reviewed on a regular basis to ensure continuous improvement, will be set.
6. Regular monitoring of water will be conducted to establish performance against set water quality objectives and targets.



RISK:

1. In the Namib Desert water is a scarce resource. Expanding communities have growing needs for potable water and many other industries require a reliable source of water. Thus there is a risk of depletion of the coastal groundwater resources.
2. The mine's operations can also affect the local water quality if contaminated water was discharged into the environment. The water quality in the Khan River downstream of the mine could be affected if not controlled.
3. Unplanned Effluent Discharges.

MANAGEMENT OF RISK:

1. Comply to legislation.
2. Recycling of tailings pond water and from boreholes on the tailings dam.
3. Seepage control system to prevent contamination of groundwater in the Khan River by:
   - Capturing surface seepage from the dam in the seepage collection dam.
   - Pumping seepage water from the well fields on the south western side of the dam for recycling.
   - Pumping seepage water from cut-off trenches in the gorges to prevent seepage water from entering the Khan River.
4. Tailings deposition designed and planned so that there is minimal risk of dam wall failure that could result in effluent discharge.
5. Tailings dam and water management plans and procedures implemented to ensure safe disposal of tailings and a stable tailings facility.
6. Geotechnical reviews of the tailings facility are done by a competent engineer to ensure that the facility is safe.
7. Acid rock drainage studies were done and these showed that there is a surplus of neutralising minerals. Thus acid rock drainage is not an issue at Rössing Uranium.
8. Training of staff in water conservation through regular communication.
9. Monitoring:
   - Daily and weekly inspections of control systems.
   - Monitoring programme for water consumption implemented throughout the mine and a monthly water balance is produced.
   - The level of the aquifer monitored by monitoring the water levels of all monitoring boreholes (±120 boreholes).
   - Water quality of the boreholes monitored as per agreed programme between the Department of Water Affairs and Rössing Uranium.
10. Groundwater analysed for radionuclides.

Figure 5: Summary of Water Management

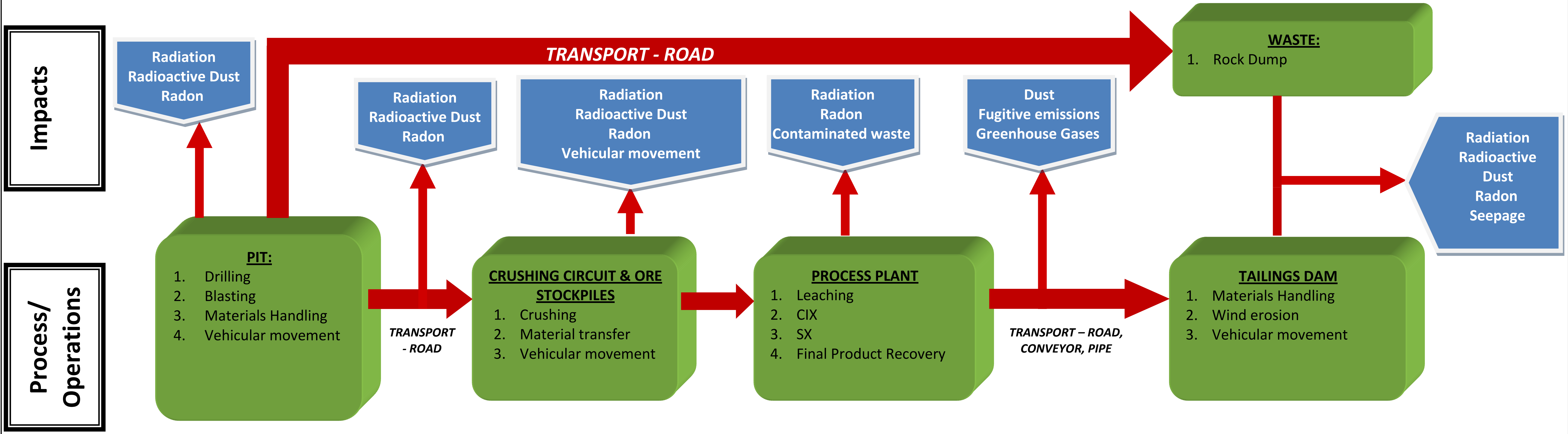
RADIATION MANAGEMENT

AIM:

1. Decrease and manage risk from operations for human health and the environment in terms of radiation.
2. Identify and assess radiation exposure.
3. Implement measures to control and manage radiation levels and thus exposures.
4. Monitor radiation exposures to ensure that Rössing's, Rio Tinto and international radiation exposure standards are met.
5. Ensure that no radioactively contaminated material leave the Rössing site.

STRATEGY:

1. The company will provide a climate in which the interests of health, safety and the environment are of prime consideration at all times.
2. The company will provide radiation training to its employees.
3. Effective controls and safe work procedures will be in place for all high-risk activities.
4. The Company will monitor legal requirements and group standards regularly in order to maintain full compliance with applicable legislative and group requirements.
5. Objectives and targets, which are reviewed on a regular basis to ensure continuous improvement, will be set.
6. Regular radiation monitoring will be conducted to establish performance against set objectives and targets.



RISK:

1. External exposure is exposure from sources external to the body, and is from gamma radiation only. Levels only slightly higher than background during mining and crushing and increasing as the uranium becomes more concentrated.
2. Inhalation of radioactive dust even if exposure is low due to low grade of material mined and processed.
3. Inhalation of radon emitted by material containing uranium and radium.
4. Ingestion of radioactive material due to poor hygiene practices.
5. Potential exposure to the public due to contaminated groundwater, radon and radioactive dust.

MANAGEMENT OF RISK:

1. Radiation management plan is in place to cover all aspects as required by Namibian legislation.
2. External exposure reduction by:
   - Access control;
   - Time restrictions for certain tasks by monitoring and limiting exposure time; and
   - Providing shielding where required.
3. Dust Suppression:
   - Dust extraction units fitted to dust generation sources in Crushing Plant and Final Product Recovery.
   - Un-tarred roads treated with chemical binder to prevent re-suspension of dust through vehicular movement.
   - Windrows created from tailings material around tailings dam to contain wind erosion.
   - Stock piles managed to reduce dust.
   - Air conditioning fitted to all cabins of mobile heavy equipment.
4. Clearance provided for any equipment that has to leave site.
5. IAEA transport regulations follwed for any radioactive material that has to leave site. This requires a permit from the Ministry of Health and Social Services
6. Monitoring
   - Monitoring programme implemented to measure identified parameters at regular intervals to ensure that standards are being met, to identify where corrective action is required and how effective the management measures are.
   - External radiation monitored to identify and control radiation in work areas.
   - Personal radiation exposures monitored (by monitoring exposure to external radiation, dust and radon).
   - Controls and personal hygiene practices monitored by determining the uranium in urine samples.
   - Stack emissions monitored.
   - Radon emissions determined from background soil and sources such as the pit, waste dumps and tailings dam.
7. Environmental dust samples and groundwater analysed for radionuclides:
   - Radiation levels determined for critical groups and the public i.e. for Arandis.
8. No unauthorised radioactive material leaves site by monitoring for contamination and through security's removal process.
9. Safe work procedures in place.
10. Annual medical monitoring provided.
11. Radiation training provided to all levels of staff.

Figure 6: Summary of Radiation Management

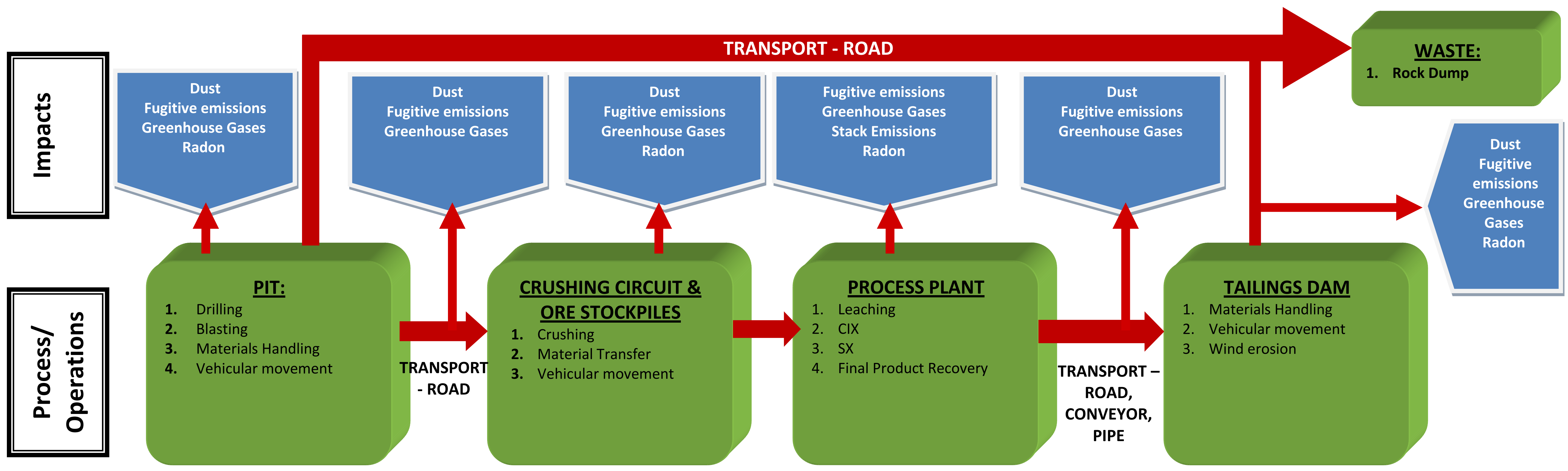
AIR QUALITY MANAGEMENT

AIM:

1. To decrease and manage air quality risk from operations in terms of human health and the environment.
2. Identify and assess air pollutants (worst case and normal operating conditions).
3. Implement measures to control and manage negative health and environmental impacts.
4. Monitor pollutants to ensure that Rio Tinto and international air quality standards are met.

STRATEGY:

1. Keep records of ambient air quality, meteorological characteristics affecting pollutant dispersion and other sources of emission close to facilities.
2. Identify and characterise all significant pollutant emissions, from all sources, including fugitive emissions and their method of release into the environment.
3. Identify, assess and prioritise all community health and environmental risks associated with exposure to individual and combined air pollutant emissions.
4. Identify environmental risk and management procedures for new developments or substantive changes to existing facilities to manage adverse impacts on ambient air quality.
5. Demonstrate that emissions under normal and worst case conditions (current or after modification) will comply with regional and national air quality regulations and licensed conditions.
6. Develop internal criteria on required air quality when government regulations are absent or incomplete to ensure internationally accepted regulations and guidelines are met.



RISK:

1. Dust and release of Particulate Matter (PM10). PM10 are minute airborne liquid or solid particles that cause air pollution and may affect human health. These include small dust particles, fume, mist, smog and smoke.
2. Fugitive emissions are pollutants released into the air from leaks in equipment, pipe lines, seals, valves, etc. These are difficult to quantify and include gases such as sulphur dioxide (SO_2), hydrogen sulphide (H_2S), sulphur trioxide/acid mist (SO_3/H_2SO_4), particulate matter (PM10), un-burnt hydrocarbons, carbon monoxide (CO) and carbon dioxide (CO_2). This may be harmful to human health if exposure occurs over specified levels and or extended time periods.
3. Point source/stack emissions are emissions from identified sources such as chimneys, stacks and vents, and are easier to quantify and measure. They include sulphur dioxide (SO_2), ammonia, nitrous oxide [a Greenhouse Gas (GHG)], carbon monoxide (CO) and carbon dioxide (CO_2) [a Greenhouse Gas (GHG)].

MANAGEMENT OF RISK:

1. Dust Suppression:
   - Dust extraction units are fitted to dust generation sources in the Crushing Plant and Final Product Recovery area.
   - Un-tarred roads treated with chemical binder to prevent re-suspension of dust through vehicular movement.
   - Wind direction checked before blasting and restricts blasting during high wind periods.
   - Undertake preventative maintenance and frequent wash-downs in fine crushing areas.
   - Windrows created from tailings material around tailings dam to contain wind erosion.
   - Stock piles managed to reduce dust.
   - Air conditioning fitted to all cabins of mobile heavy equipment.
2. Stack Emissions:
   - Scrubbers fitted and maintained and baghouses provided in stacks to capture emissions.
3. Fugitive Gas Emissions:
   - All vehicles and machinery maintained and repaired as required to prevent leaks.
4. Monitoring
   - Monitoring programme implemented to measure identified parameters at regular intervals to ensure that standards are met and to identify where corrective action is required and how effective management measures are.
   - Dust monitored on the mine and in surrounding areas (using dust samplers) for one day every eight days.
   - Electricity usage monitored to determine GHG, total electrical and fuel usage.
   - Stack emissions monitored annually.
5. Results analysed (compare against baseline measurements) – changes implemented if required to manage areas of concern arising from monitoring.
6. Green House Gases (GHG):
   - Operational efficiency increased to reduce GHG produced – electricity, diesel, petrol, extraction and other process consumption, explosives, transport of products and major reagents and waste production.
   - Maintain annual register of GHG.
7. Emergency preparedness and response procedures to respond to abnormal emission and dispersion conditions, with measures to protect community health are in place.

Figure 7: Summary of Air Quality Management

NOISE AND VIBRATION MANAGEMENT

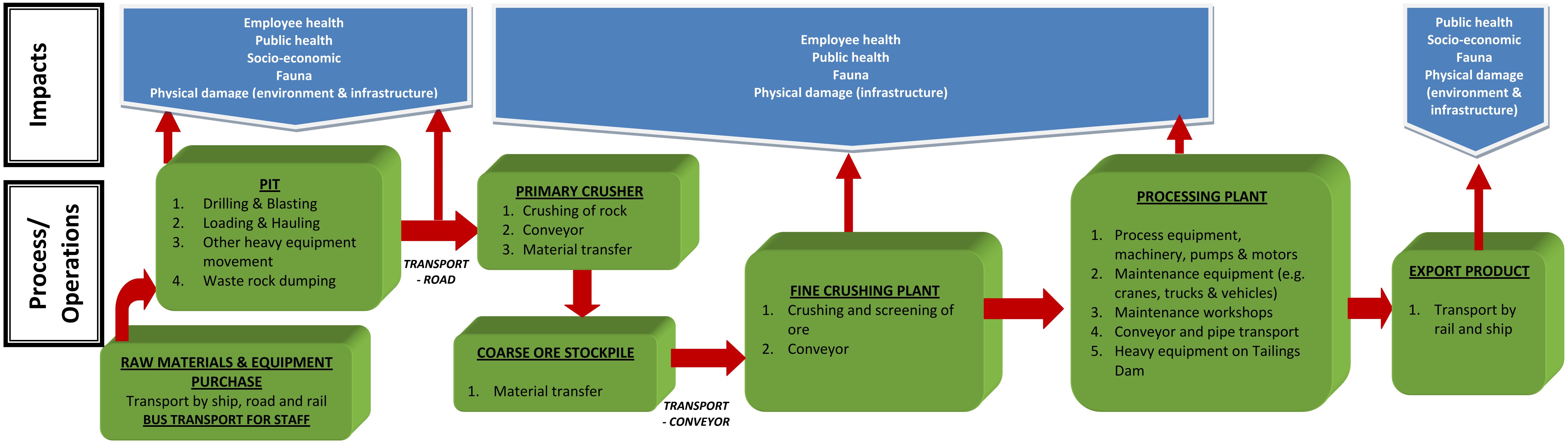
AIM:

To decrease and manage noise and vibration risk from all mining operations and related activities, on and off site and including contractors, in terms of human health and the environment by:

1. Identifying, assessing and prioritizing sources of noise and vibration (worst case/impulse and normal operating conditions) according to impact significance;
2. Designing and implementing appropriate measures to control and manage negative impacts;
3. Monitoring noise and vibration levels to ensure that Rio Tinto (based on internationally accepted criteria and adopting the most conservative), ISO and regulatory, standards are met; and
4. Striving to accommodate the expectations of surrounding communities.

STRATEGY:

1. Keep records of baseline noise and vibration levels (i.e. from other sources when no mining activity is occurring), as well as noise and vibration levels for existing mining operations.
2. Maintain records of weather characteristics affecting noise and vibration propagation and noteworthy external sources of noise and vibration close to facilities.
3. Identify and characterise all activities that generate significant noise and vibration, and understand how differing weather and operational conditions affect the generated levels and propagation.
4. Identify, assess and prioritise all public health and environmental risks associated with exposure to individual and combined noise and vibration generation.
5. Identify environmental risk and management procedures for new developments, or substantive changes to existing facilities, to manage adverse impacts on the near and the far field noise and vibration levels. Predictive modelling will be used where necessary.
6. Develop internal criteria on required noise and vibration levels when government regulations are absent or incomplete, to ensure internationally accepted regulations and guidelines are met and to ensure the protection of public health and the environment.
7. Demonstrate that noise and vibration levels under normal and worst case (impulse) conditions (current or after changes) comply with Rio Tinto internal, ISO and regulatory standards.



RISK:

1. Public health impacts: physiological and psychological changes, e.g. hearing loss, stress, headaches.
2. Socio-economic impacts: changes in societal behaviour/matrix due to persistent noise/vibration, e.g. change in settlement areas and movement corridors of communities to adapt to disturbance, tourism and economic impacts.
3. Impact on fauna (including aquatic and birds): physiological and behavioural changes, e.g. change territory boundaries due to disturbance.
4. Physical damage to environment: trees, landscape and geology.
5. Physical damage to built infrastructure: roads, buildings.

MANAGEMENT OF RISK:

1. Noise and vibration surveys conducted to identify noise and vibration generating equipment and noisy areas.
2. Noise zones are demarcated by placing hearing protection pictograms in areas and on equipment.
3. A noise and vibration reduction program was introduced to reduce noise levels in areas where unacceptable levels were found. These include:
   - Sound proofing of buildings and work areas; and
   - Sound proofing of equipment e.g. double glazing of cabins of mobile equipment.
4. Noise and vibration specifications included into the equipment purchasing criteria i.e. noise levels to be below 85dBA.
5. Reduce the dependence on wearing ear protection and as part of continuous improvement, targets for the reduction in the number of employees and contractors having to work in areas above 85dBA have been set.
6. These targets are reviewed and reported to Rio Tinto annually.
7. Using access control to reduce exposure e.g. having to obtain permission prior to entering an operational area.
8. Training of employees in noise and vibration includes:
   - Danger of noise and vibration;
   - Effects of noise and vibration on the human body;
   - How to reduce exposure; and
   - How and where to use hearing protection.
9. Wearing of hearing protection equipment e.g. ear muffs, ear plugs and personalized ear protection (variphones).
10. Monitoring Program:
    - Workplace monitoring to ensure that noise levels remains constant;
    - Personal monitoring to ensure exposure levels remain within standards;
    - Hearing proficiency testing done during periodical medical surveillance; and
    - Monitor compliance against regulation requirements and to the internal noise and vibration standard.
11. Personal health, safety and environment interactions done on site assists in improving employee awareness in understanding the noise and vibration hazard.
12. Audits are done to ensure that noise and vibration programs and procedures are being followed.

Figure 8: Summary of Noise and Vibration Management

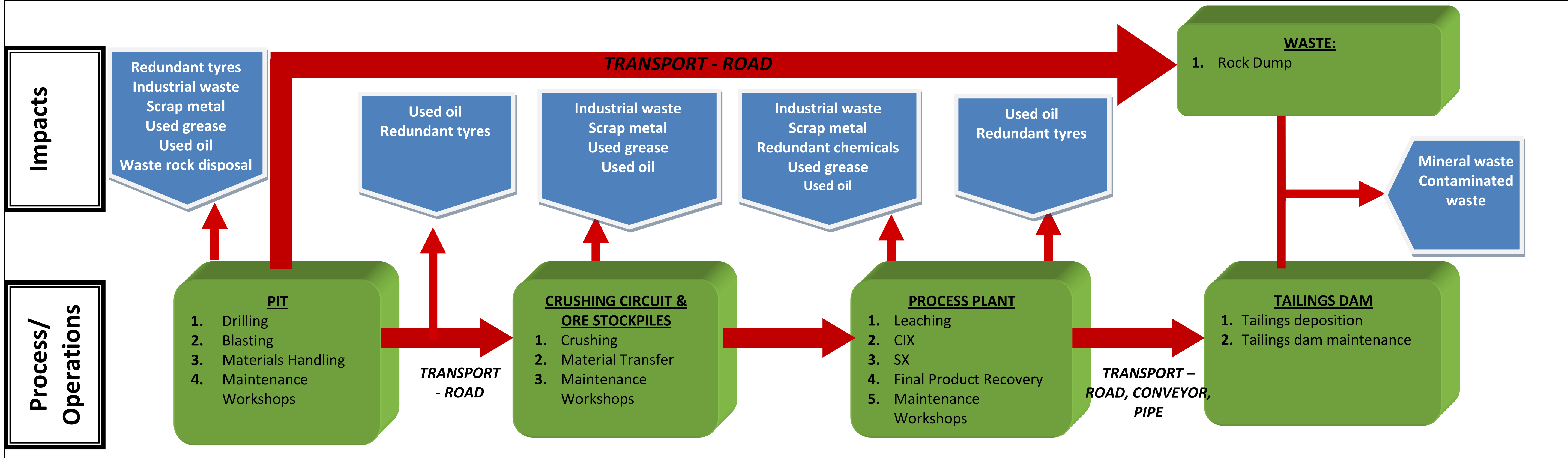
WASTE MANAGEMENT

AIM:

1. To responsibly manage and dispose of waste according to their volume, safety requirements and potential impact on the environment.
2. To develop strategies to reduce, recycle and treat future wastes so as to ease the problem of waste disposal.
3. To incorporate waste management, waste reduction strategies and waste site remediation into the Environmental Management System.

STRATEGY:

1. Compliance with the Rössing Policy Statement on Health, Safety and the Environment which commits the mine to:
   - Complying with appropriate health, safety and environmental legislation;
   - Striving to minimise the impact on the environment in the widest context, by adopting the principle of best contemporary practice during its operation and after closure; and
   - Limiting Company exposure to environmental risk by identifying, controlling and monitoring environmental impacts on a regular, systematic basis.
2. The waste management strategy is based upon the accepted principles of waste reduction at source and recycling and reuse wherever possible. Disposal of waste to a landfill is carried out only where no economically viable alternative exists.
3. Waste is disposed of according to its characteristics.



RISK:

1. If not properly managed, contamination of the environment resulting in loss of flora and fauna and human exposure to pollutants.
2. Contamination of ground water through effluent discharge, acid rock drainage (ARD), leaching of other chemical or seepage of contaminated water.
3. Poor or improper design of waste facilities such as waste rock dumps and tailings facilities could result in safety concerns and loss of flora and fauna.

MANAGEMENT OF RISK:

1. Risk assessments conducted to determine and address risks.
2. Seepage control system to prevent contamination of groundwater.
3. Studies to determine if acid rack drainage will be generated at waste rock dumps have showed that ARD is not an issue.
4. Proper planning and design of waste disposal facilities are done by competent engineers.
5. Regular geotechnical reviews of the waste rock and tailings dam by competent independent engineers to ensure best practice is followed and that facilities will remain stable.
6. Regular inspections of waste sites are carried out to ensure compliance to standard procedures.
7. Waste management procedures are set up for all waste produced.
8. Records of all waste is documented and maintained. Certificates of Safe Disposal for all hazardous and recycled wastes kept.
9. Waste Material Bins are used for the storage and handling of all waste materials and are located at the source of generation e.g. workshops, stores and offices. These bins are categorized and color coded as follows:
   - Domestic Waste **(YELLOW).**
   - Contaminated Waste **(WHITE).**
   - Scrap Metal **(GREEN).**
   - Hydrocarbon Contaminated Waste (oil filters/pipes) (**BROWN**).
   - Salvageable Waste (cardboard) (**YELLOW CAGES**).
   - Paper (recycle boxes).
   - Oil (contained in leak proof 210 ℓ containers temporary stored in bunded access controlled area prior to recycling).
   - Greases (contained in leak proof 210 ℓ containers temporary stored in bunded access controlled area for dispatch to hazardous waste site).
10. Training on waste disposal requirements and procedures are addressed through induction of all new employees and yearly refresher training.
11. Some of the waste produced at Rössing Uranium is recycled, such as scrap metal, cardboard boxes, wooden scrap, empty 210ℓ metal drums, scrap paper and used oil.

Figure 9: Summary of Waste Management

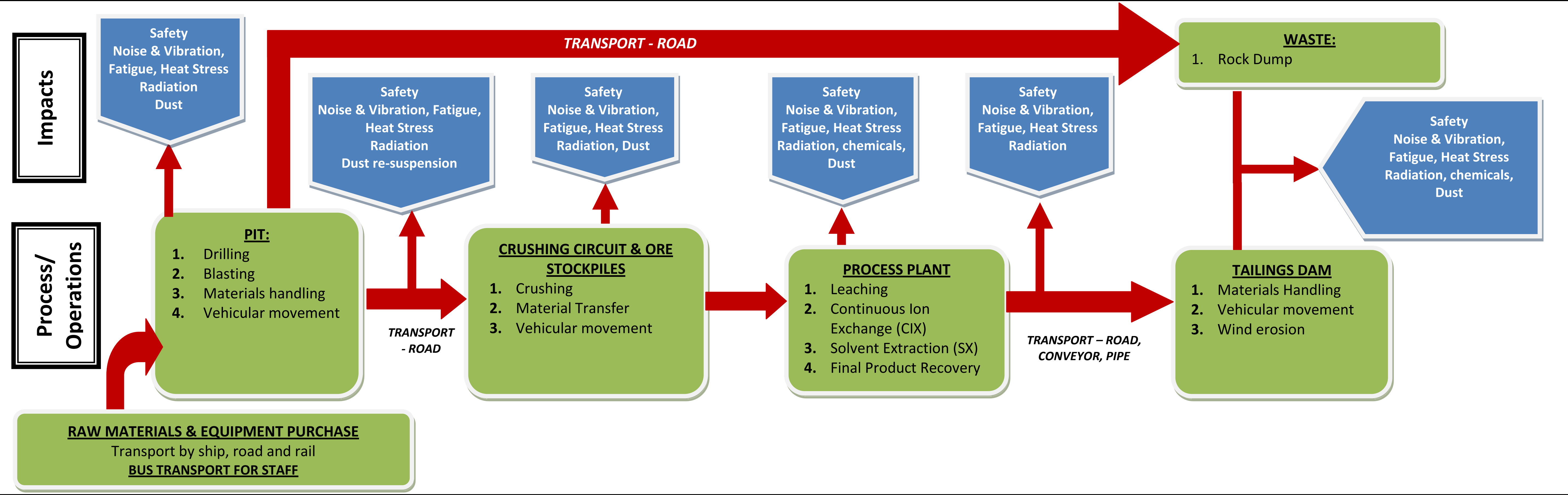
HEALTH AND SAFETY MANAGEMENT

AIM:

- To protect the health and safety of employees, contractors and visitors;
- To be in full compliance with all applicable legislation, standards and requirements;
- To seek continual improvement in HSE performance and adopt leading practices where applicable and feasible; and
- To identify and assess hazards arising from mining activities and manage associated risks to the lowest practical level.

STRATEGY:

1. The company will provide a climate in which the interests of health and safety are of prime consideration at all times. The company will also provide the correct equipment for doing the job.
2. The company will provide regular medical examinations to all its employees and contractors as part of a preventative programme for the early detection of occupational diseases.
3. The company will continuously work on reducing new cases of occupational diseases through identification, evaluation and control of workplace exposures.
4. Effective controls and safe work procedures are in place for all high-risk activities.
5. All safety incidents will be investigated to identify all controllable causes so as to prevent any possible recurrence of any such incident.
6. Employee's abilities and competencies will be assessed and developed before selection and job placement.
7. Employees will be trained in HSE management and in performing risk assessments. All personnel will carry out informal risk assessments prior to performing their daily tasks and will work accordingly.



RISK:

1. Health and safety impacts to employees, contractors, and visitors and public.
2. Loss of efficiency in work force due to low self esteem and motivation that results from injuries.
3. Increase in operation costs that results from having employees off work due to injury or illness.
4. Poor reputation resulting from poor safety record can result in loss of business.

MANAGEMENT OF RISK:

1. Policies are set up to improve health and safety (HS) e.g. alcohol and drug policy, smoking policy and HIV and AIDS policy.
2. HS hazards are identified and their resulting risks evaluated and managed.
3. Objectives and targets to drive continuous improvement are established and plans are developed to achieve them.
4. People are trained to understand the risks and controls associated with the activities that they perform.
5. A management of change system for ensuring that changes associated with any element, control, process system or document that could introduce new HSE risks are effectively managed and recorded.
6. Management will be visible in all areas to demonstrate their commitment to HSE.
7. To ensure the effectiveness of the HSE management system, HSE performance is evaluated and reviewed.
8. Procedures have been established, implemented and maintained to address significant HS risks/impacts and potential deviations. Examples include:
   - Code of practice for the control of asbestos at work;
   - Code of practice on hearing conservation;
   - Occupation hygiene monitoring;
   - Respiratory protection programme; and
   - Radiation management plan.
9. Monitoring:
   - All occupational diseases are monitored and controls put in place to minimise impacts to workers. This includes monitoring for dust, radiation, noise and vibration and chemical vapours, etc.
   - Medical examinations to all its employees and contractors as part of a preventative programme for the early detection of occupational diseases.
   - Assess performance and carry out audits to ensure compliance to procedures.

Figure 10 : Summary of Health and Safety Management

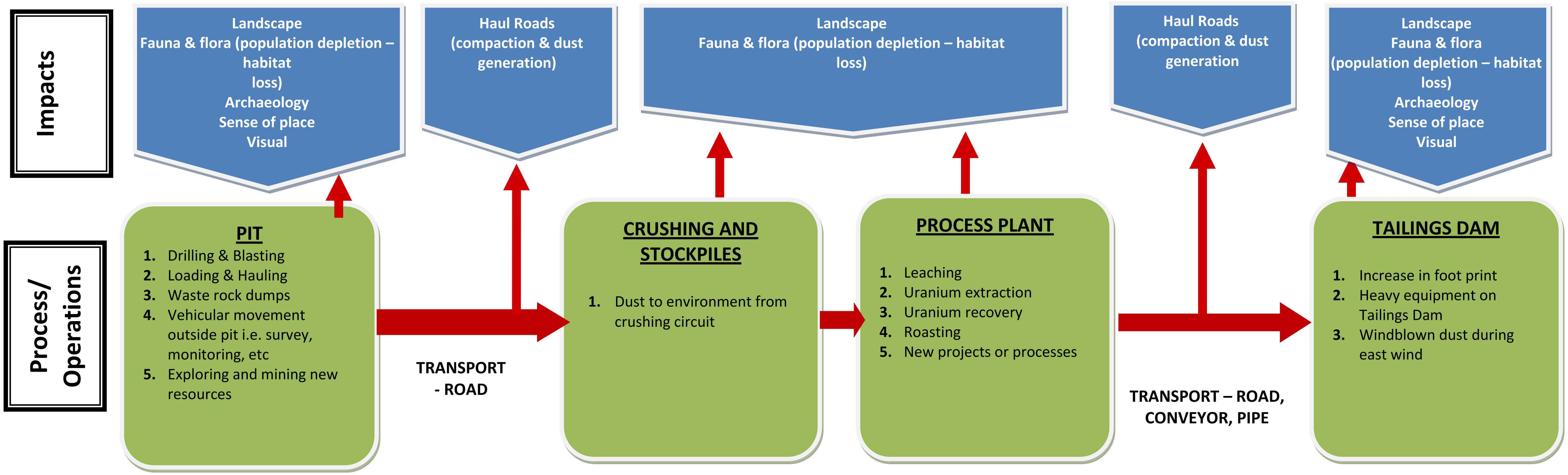
LAND-USE STEWARDSHIP

AIM:

1. Promotes an integrated and sustainable approach to land management:
   - Aspects of biodiversity conservation;
   - Environmental offsets;
   - Interactions with adjoining lands, including communities; and
   - Legacy and protection of socio-cultural and natural heritage features.

STRATEGY:

1. Enhance biodiversity proctection by assessing and considering ecological values and land use aspects in investement, operational and closure initiatives.
2. Implementation of an Environmental Management System (EMS): manage environmental related aspects in a manner that is planned, controlled, monitored, recorded and audited.
3. Maintain certification status (ISO 14001 or European Eco-Management and Audit Scheme).
4. Training of personnel, to ensure that they are aware and competent when using land.



RISK:

1. Noise and activities will deter wildlife from foraging in or moving through the area. Endemic species may become extinct.
2. Increased poaching activities or illegal collecting of plants.
3. Loss of wilderness appeal and areas of high biodiversity value, and thus the tourism potential of the region.
4. Loss of essential ecological processes which support life in the Central Namib.
5. Fragmentation and/or complete destruction of habitats – endemicity of species.
6. Extent of impacts beyond the boundaries of the mining licensing area (e.g. water contamination, dust generation from mining activities affecting plant species).

MANAGEMENT OF RISK:

1. Open pit:
   - Open pit and waste dumps designed to be geotechnically stable to create safe and stable conditions for humans and wildlife.
   - Understand the geochemical characteristics of the waste rock to minimise impacts from chemical leaching.
2. Plant (Infrastructure and potentially contaminated sites):
   - Achieve ecological stability.
   - Soil clean up and biodiversity targets to be set.
   - Achieve a self sustaining, stable natural habitat integrated into the surrounding environment for the long term.
3. Tailings dam:
   - Surface and groundwater managed to protect the environment against exposure to hazardous waterborne chemicals. The water quality should remain within the range of natural variability.
   - Ensure that the Khan River and thus the lower Swakop river are not negatively affected by seepage from the tailings dam.
   - Stability of tailings dams against water, wind erosion and seismic events.
4. Geometry of facilities blend in with the desert environment.
5. Remaining disturbed footprint:
   - Areas, similar to the rest of the mining licence area, should blend into the surrounding habitat and be stable and safe over the long term.
6. Natural surrounding environment:
   - Disturbance in surrounding areas avoided.
   - Undisturbed areas are protected from unnecessary disturbance.
   - Rehabilitation of areas should not seek materials from adjacent areas, as this causes more disturbance.
   - Sites classified into different categories, according to the biodiversity value.
7. Management of change process is followed before any significant change in land use is made.
8. Monitoring:
   - Ongoing monitoring of biodiversity features, e.g. fauna and flora.
   - Review environmental data on a regular basis.
   - Procedures maintained to monitor and measure activities that can lead to impact on the environment.
   - Completion of EIA prior to any major project. This EIA has to be approved by Rio Tinto prior to release of funding.

Figure 11: Summary of Land-Use Stewardship