Managing naturally occurring radioactive material (NORM) in mining and mineral processing — guideline

NORM–2.2

Preparation of a radiation management plan — mining and processing

Government of **Western Australia**
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1. General information

1.1. Purpose

To provide guidance on the development of a suitably detailed radiation management plan (RMP) for the control and monitoring of radiation exposure and the management of radioactive wastes.

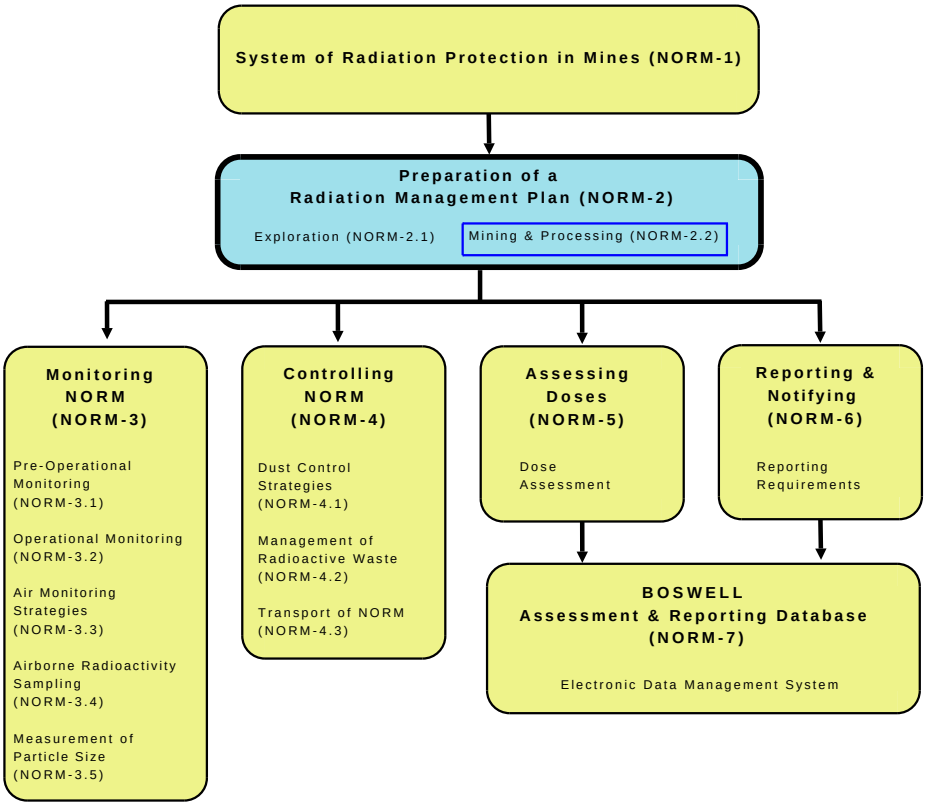
1.2. Scope

This guideline applies to all mining and mineral processing operations in Western Australia that use or handle naturally occurring radioactive material (NORM) and come within the scope of Part 16 of the Mines Safety and Inspection Regulations 1995 [1].

1.3. Relationship to other NORM guidelines

The flowchart in Figure 1.1 shows the arrangement of the Radiation Safety Guidelines.

Figure 1.1.: Relationship to other NORM guidelines



2. Guidance

2.1. Summary

The mines and processing plants in Western Australia that use or handle naturally occurring radioactive materials (NORM) come within the scope of Part 16 of the Mines Safety and Inspection Regulations 1995 [1]. Some processing plants are not classified as mining sites and are regulated by different legislation (Radiation Safety Act and Regulations). However, the Mines Safety and Inspection Regulations cover the disposal of waste material from these plants if this disposal occurs at a mining site.

Each responsible person at a mining and/or processing operation (i.e. principal employer, any other employer and the registered manager) must ensure that adequate measures are taken to control the exposure of employees and members of the public to radiation at or from the mining/processing operation that handles and/or uses NORM. Each responsible person must, therefore, consider the protection of the health and safety of workers and the protection of the environment at all stages in the design, planning, construction and operation of the facility. Before commencing operations a plan for the safe management of radiation should be submitted to the appropriate authority for approval. Where a mine currently exists, the radiation management plan must be prepared as soon as is practicable after the commencement date.

It is important that best practicable technology is incorporated into the design of facilities at a mining/processing site. For example, the location of radioactive mineral stockpiles, tailing's storage facilities and exhaust stacks in relation to regularly occupied workplaces and critical groups of the members of the public have a significant effect on the radiation exposure of the different groups of people and on the most effective manner in which operational procedures are carried out.

Regulation 16.7(2) [1] specifies general measures that must be considered in the development of a Radiation Management Plan (RMP) and the purpose of this guideline is to outline in more detail various elements that need to be included in the RMP.

The level of detail included in the RMP depends on the degree of potential radiation exposure, which has been estimated or identified, and the expected difficulty of controlling it. RMPs for uranium milling and monazite treatment would be more comprehensive than those prepared for a mineral sands processing, which in turn would be more comprehensive than those prepared for other mineral processing operations, such as zircon milling or titanium dioxide production, or management of radon in non-uranium underground mines. Please note that for the purposes of Mines Safety and Inspection Regulations 16.7 and 16.8 [1] the 'NORM Management Plan' suggested by ARPANSA Safety Guide [4] is considered to be a Radiation Management Plan and all regulatory requirements are applicable.

In order to ensure that the RMPs developed by the operator are consistent with the requirements of the legislation, and to allow prompt and efficient evaluation of these RMPs, the continuing consultation between the operator and regulator is required. Separate approvals from the State Mining Engineer for the various stages of operations are usually necessary, such as:

- authorisation to explore;
- authorisation to construct;
- authorisation to operate;

- authorisation to cease operations (temporarily or permanently);
- authorisation to rehabilitate; and
- authorisation to make significant changes in operations and/or in the system of radiation protection.

It may also practicable in some cases to describe radiation management at the operation in two documents:

1. Radiation Management Plan (RMP)
2. Radioactive Waste Management Plan (RWMP)

as suggested by the Australian code of practice for radiation protection and radioactive waste management in mining and mineral processing [3].

To ensure ongoing relevance, the Radiation Management Plan must be reviewed within 2 years of the start of mining operations, and at subsequent specified intervals.

3. Elements to be included in a Radiation Management Plan

3.1. Document format and cover sheet

The RMP should be a 'controlled' document, with each page dated and clearly identified. The cover sheet should include:

1. The title of the document
2. Document identifier (unique reference number relevant to the operation)
3. Date of submission to the appropriate authority
4. The name of the company and a particular operation
5. Signed endorsement by Registered Manager

3.2. Scope of the Radiation Management Plan

The RMP should detail the specific operations/facilities described in the document, including the name and location of the mine/plant, the number of the lease, tenement or other interest and the name and address of the principal employer at the mine.

The specific operations may include surface mining, underground mining, mineral processing, smelting, refining or waste disposal. Usually a separate RMP (and, where applicable, RWMP) are required for each separate site to which Part 16 of the Mines Safety and Inspection Regulations apply.

3.3. Introduction

The introduction should detail the history of the site and ownership (where necessary) and the reason a RMP is required. Whilst this reason is clear in cases of uranium and mineral sands operations, for other facilities such as tin and tantalum processing, or for some underground mines the source of the radioactivity needs to be described.

The mining and/or mineral processing activities to be undertaken on the site, including a description of the type of mine, the treatment of minerals that is to take place at the site, the expected duration of mining and/or processing operations and the critical project dates for construction and commissioning of facilities, should be summarised. The site operations summary could be enhanced by the inclusion of a block diagram of broad functional activities, showing inter-relationships.

3.4. Workforce information

The number of persons who will be employed at the facility should be detailed. This requires workforce stratification as a function of the work category, gender and type of employer (company or contractor).

The proposed shift roster system to be used, the likely average annual working hours and those employees or categories of employees who will be designated should also be described.

3.5. Critical group information

Critical group is a group of members of the public comprising individuals who are relatively homogeneous with regard to age, diet and those behavioural characteristics that may affect the doses received and who are likely to receive the highest radiation doses from a particular operation. The likely critical groups of the public should be identified and the location of these groups shown on a suitable location plan.

The size and demographics of the critical groups should also be briefly described. In some cases identification of the critical group may not be possible due to the distance from the proposed site being too far for a group to receive any measurable radiation dose. However, even in such situations, there still exits a need for the operator to demonstrate that the impact of the operation on the local environment is minimal or negligible; and, in these cases a reference plant/animal may be selected for the study, after the consultation with an appropriate authority. The flora/fauna selected should, in these cases, described in the RMP.

3.6. Sources and pathways of radiation exposure

The RMP should contain sufficient information to allow all significant exposure sources and pathways to be identified. This should include plans of the mine and/or processing plant, descriptions of the equipment to be used and processes involved, and estimates of the radionuclides' concentrations in process and tailing streams.

A radionuclide mass balance is typically required, with all inputs, outputs and wastes clearly identified and characterised from a radiological perspective. Consideration should be given to the potential for the accumulation of radioactive scales and/or sludges inside the processing vessels and in associated pipe work. All process inputs, outputs and wastes that require specific consideration from a radiological perspective should be clearly identified.

Estimates of the radiation levels to which various categories of employees and critical group(s) could be exposed should be provided, using appropriate exposure pathway models and/or contemporary experience. Suitable and sufficient scientific justification, including references where appropriate, should be provided for any models, assumptions or data used in the estimation process.

3.7. Equipment and facilities for controlling radiation sources

The RMP should identify the measures that will be implemented to control radiation exposures. This should include provision of such engineering controls as ventilation, dust and fume control measures, and shielding.

The specific mining and/or mineral processing equipment to which engineering control methods will apply should be listed and the measures that will assure adequate control of radiation exposure should be outlined.

Elements of plant and equipment design which assist in minimising radiation exposure must also be detailed, such as layout of plant and equipment, housekeeping measures, and contamination and spillage control. Diagrams that show the location of regularly occupied workplaces, such as offices, control and crib rooms, in relation to radioactive process streams, stockpiles and tailings piles should

also be included. Measures limiting access to controlled and restricted areas should also be described, including physical barriers and administrative controls.

Summary details of engineering control technology, such as the specifications of the equipment, should be provided together with location details of process exhaust stacks, where applicable.

The features that should be considered during design of a plant processing radioactive minerals include:

1. Efficient movement of radioactive materials and process streams and the safe movement of workers.
2. Location of dust-generating activities, such as crushing in relation to other activities.
3. Physical separation of processes containing elevated concentrations of NORM from frequently occupied areas.
4. Ventilation of, and provision of services such as washing facilities to, control and crib rooms.
5. Method of movement of dry materials by conveyors or through pipes and chutes.
6. Efficiency of various ventilation control techniques (the fact that high ventilation rates used to reduce radon accumulation may result in excessive dust re-suspension from surfaces should be taken into account, where applicable).
7. Accessibility of equipment for the purposes of maintenance, removal and replacement.
8. Materials used in the construction of plant and equipment (e.g. the use of hard materials would prevent particles of mineral embedding firmly onto surfaces and will therefore, reduce the potential for non-removable contamination of surfaces).
9. Need for containment bunds and the manner in which spilt process material will be returned to the process.
10. The degree of automation for identified critical processes, such as handling and packaging of radioactive material.
11. Use of high reliability equipment with minimal maintenance requirements in circuits where materials with significantly elevated concentrations of radionuclides are treated.
12. The most important consideration in the design of facilities for the processing of NORM is the containment of radioactive materials. The materials that cannot be effectively contained within the process should be controlled by means of ventilation and dust suppression to prevent the release of the material into the environment and to minimise the potential occupational exposure.
13. Adequately designed and balanced ventilation and dust control systems are typically the most effective methods of minimising radiation exposure in both underground and surface mines, and in the plants processing dry minerals.
14. The generation of dust should be minimised by the use of appropriate techniques such as the use of water and other means of suppressing dust and the use of appropriate equipment.
15. Where dust is generated, it should be suppressed at the source. If practicable, the source should be enclosed under negative air pressure.
16. Care should be taken to avoid the re-suspension of dust as a result of equipment vibration and high air velocities.
17. During maintenance operations, special care should be taken to control the occupational exposures that may arise from the buildup of dust on internal and external surfaces of the equipment, accumulation of radioactive material in pipes and vessels due to the formation of sediments and the buildup of scale, and build-up of radon/thoron in enclosed areas such as mineral storage tanks.

18. Only when engineering methods of dust control do not achieve acceptable air quality in working areas, personal respiratory protection should be provided to employees.
19. It is also important to ensure that dust control is an integral part of an overall system of occupational hygiene. For example, some elements of dust extraction/collection system may be a significant source of exposure of employees to unacceptable levels of noise.

3.8. Institutional controls

The RMP should clearly show the assignment of responsibilities in regards to radiation protection and accountability for radioactive sources, and the commitment of the organisation to maintain high levels of occupational health and safety. Where necessary, a specific radiation protection policy should also be developed.

The primary responsibility for the implementation of the RMP is usually delegated to the appropriately qualified radiation safety officer (RSO). The requirements may change depending on the scale of operations and the levels of potential radiation exposure but, typically, an RSO is expected to have a degree in physical science or equivalent and several years of experience in radiation protection, preferably in the mining and mineral processing industry. Where RSO is also undertaking air monitoring it is important to note that the person is expected to have the minimum qualification of a surface ventilation technician/officer and be a 'CONTAM registered sampler'. The main duties of the RSO are advising the management on the implementation of the RMP and on all matters in relation to radiation protection of employees, public and the environment; and the RMP should clearly describe these duties.

A description of the operational procedures and practices should be provided in the RMP, including, among other issues:

1. Designation of supervised, controlled and restricted areas and procedures for access control (e.g. physical barriers, signs, special work permits).
2. Designation of employees according to the levels of radiation exposure.
3. General housekeeping measures.
4. Correct operation of control equipment, including preventative maintenance measures and schedules.
5. Standard operating procedures for critical operations from a radiation protection perspective, including special procedures to be followed during certain identified maintenance tasks (it is sometimes practical to compile these procedures in a separate document that may be submitted to the appropriate authority as a supplement to RMP).
6. Emergency planning and response for accidents involving radiation.
7. Use of personal protective equipment.
8. Inspection and auditing program to ensure that correct work practices and procedures are being followed.
9. Controlled area work rules.

The location of controlled and supervised areas should be marked on an appropriate plan together with the location of caution signs. Details of the wording of signs, notices and special work permits used for access control should also be provided.

Although it may be appropriate in many cases for the boundaries of supervised areas to be marked with signs, this may not always be necessary or productive. It may be necessary to designate a

supervised area within a mining/processing site to which members of the public may have access, but signs at the entrance to the site may cause unwarranted concern.

The areas in which gamma dose rates or airborne concentration limits may be approached or exceeded should be designated as requiring special precautions for entry and classified as restricted areas. The additional requirements for personnel performing operations, maintenance and repair work in such areas should be specified, together with any specific instructions and training to be provided to workers. Procedures for visitors should also be provided.

The primary reliance for radiation safety and control should be placed on properly designed facilities and engineered controls rather than on personal protective equipment. Dust (and radon/thoron) should usually be controlled in a such a way that protective equipment is not necessary for routine tasks. However, there may be situations where engineered controls cannot reasonably be provided and the use of such equipment is necessary. Respiratory protection equipment may also be needed in emergencies, for repair and maintenance, and in special short term circumstances.

The situations when personal protective equipment is required should be summarised, with details being provided of the location, task, reason for the need of protective equipment, its type, and expected frequency and duration of task. The procedures for proper fitting, training, cleaning, maintenance and inspection of personal protective equipment should also be summarised.

For additional guidance please refer to the respiratory protection section in Appendix B of NORM–4.1 Dust control strategies.

Personal hygiene rules should also be established and compliance with them should be continuously monitored. In the first aid procedures special precautions in cleaning of wounds potentially contaminated with radioactive material must be clearly described.

When employees are required to work in areas with relatively high levels of radiation exposure and when no other practicable means of control are available (for example in underground workings with unusually high uranium concentrations and radon levels), job rotation could be used in order to restrict the radiation exposure of individual workers. Job rotation, however, should not be used as a substitute for the development of an appropriate radiation protection system.

3.9. Employee training

All employees who may be exposed to radiation and all persons responsible for the implementation of the RMP should receive appropriate training.

Senior management and employees in other departments (such as public relations, human resources, administration, marketing, etc) should also be provided with information on risks associated with radiation exposure and detailed description of sources and pathways of radiation exposure at relevant mining and processing sites.

Employees whose work may impact on the levels of radiation exposure (designers, planners, etc) should also be provided with basic information.

Training programs should include relevant information and the following information should be provided in the RMP:

1. Details of the induction program (i.e. training for new employees), including summary of topics covered, duration and context in relation to overall induction.
2. Details of periodic re-training, including format, duration and frequency.
3. Details of any additional training given to the management personnel.
4. Details of any emergency response and preparedness training.

The qualification and experience of the person conducting the training (if not done by the RSO) should also be provided.

The nature and extent of employee training is expected to vary with job requirements and responsibilities. For a person whose duties do not include work in a controlled area, a simple description of the working environment, protective measures and average levels of exposure may be sufficient. However, for a person who is typically required to perform tasks in controlled areas on a regular basis, much more detailed and extensive training program is necessary, particularly in relation to the compliance with safe work procedures and the use and maintenance of protection equipment.

3.10. Radiation monitoring program

The main aims of monitoring radiation levels in the workplace and in the environment are to:

- determine compliance with regulatory limits;
- determine radiation exposure of employees and members of general public;
- assess the impact of operations on the local environment;
- provide information on the effectiveness of control measures; and
- access whether doses are as low as practicable (e.g. checking the effectiveness of control measures, studying specific tasks, identifying poor work practices, investigating incidents).

A detailed description of the radiation monitoring program should be provided in the RMP. The program should list for each radiation–related parameter (external radiation, airborne radioactivity, waterborne radioactivity, radon/thoron, and surface contamination) the following:

1. Location, task or category or employees monitored.
2. Environmental media (air, water) monitored.
3. Type of sampling (personal, positional, ground water, surface water, etc.).
4. Duration of sampling.
5. Frequency of measurement.
6. Sampling equipment and calibration records.
7. Analysis method, the type of radiation or radionuclides measured.
8. Any other information, as applicable.

The parameters to be measured should include all those identified in Section 3.6 on page 5.

For additional guidance please refer to NORM–3.1 Pre-operational radiation monitoring requirements and NORM–3.2 Operational radiation monitoring requirements.

In the case of a new operation, an initial monitoring program should be exhaustive in order to thoroughly characterise the radiological environment and to identify any locations and/or work practices requiring special attention. When the radiation levels stabilise and it is established that a facility operates under normal conditions, monitoring frequencies and locations should be adjusted to reflect the level and variability of different radiation parameters. In general, more frequent monitoring is required where levels are higher and variable; less frequent monitoring is required where levels are low and relatively constant.

Surface contamination measurements are the main method of assessing housekeeping standards, and are useful in the inspection of equipment prior to maintenance. Surface contamination monitoring is very important in the control over release of potentially contaminated equipment from site and, therefore, will usually be an integral component of the monitoring program.

The need for monitoring of radon/thoron concentrations is dependent on a particular site conditions. In mineral sands operations it is not usually necessary to assess radon/thoron concentrations in open pits; however in situations where large amounts of mineral are present in enclosed buildings, this monitoring is typically a part of a program. These measurements are also usually necessary in underground mines and in situation when a material contains elevated concentrations of uranium.

The general monitoring guidance is suggested in Table 3.1.

Table 3.1.: General monitoring guidance

Radiation radionuclide level	Monitoring
Average levels <25% of occupational limits.	Initial assessment and periodic confirmatory surveys; repeat as conditions change.
Significant number of individual measurements >25% of derived occupational exposure limits.‡	Commence routine monitoring of the workplace.
Dose, average concentration, reaches or exceeds 25% of occupational limits.	Individual exposure assessment: External — personal dosimeters/badges. Internal — personal samplers (dust), area sampling and exposure time (radon).
Individual measurements approach or exceed derived occupational exposure limits.‡	Repeat the measurement.
Confirmed level approaches or exceeds occupational exposure limits.	Intensive monitoring in conjunction with re-evaluation of dose-reduction planning (with an advice from the appropriate authority).

‡Derived limit = radiation level that would result in the annual exposure equal to the statutory limit.

The RMP should include details of the quality assurance program for the radiation monitoring program, including the various actions, which are taken to assess the adequacy of equipment, instruments and procedures against established requirements such as the:

- quality and specifications of equipment and instruments;
- training and experience of personnel using equipment and instruments;
- verification of measurement procedures by the analysis of control samples and the use of standard methods for analysis (where applicable);
- frequency of calibration and maintenance of equipment and instruments;
- details and frequency of independent audits (where applicable);
- need for traceability of the results of monitoring programs to the National Standard; and
- degree of documentation needed to demonstrate that the required quality has been achieved and is maintained.

The samples such as filters from dust monitoring need to be kept for two years for the purpose of comparative analyses, if necessary.

3.11. Records management and reporting

The RMP should list the type of records to be kept, their format and method of storage. Records of monitoring results, dose assessments (including calculation methods), and related information should be retained in an easily retrievable form and kept for a period of at least 30 years.

The amount of records to be kept and their type will depend on the magnitude of potential radiation exposure on a particular site.

Typically the RMP should require the records that are kept include the following:

1. Information on radiological conditions at the particular site (external gamma-radiation surveys; airborne and waterborne radioactivity surveys, particle size characterisation assessments, surface contamination surveys, inventory of radioactive materials, methods and locations for the disposal of radioactive wastes).
2. Assessments of radiation exposure of employees and members of the public (external and internal radiation doses, and methods for their determination, bio-assay data — where applicable).
3. Assessments of impact on the local environment (measurements of all potential pathways of radioactive material discharges, environmental exposures — modelling and assumptions used in assessments).
4. All documentation relevant to the implementation of the system of radiation protection on the site (safety assessments of whole operations and designs of relevant processing equipment; descriptions of unusual operational events, standard operating procedures and relevant company policies, descriptions of training programs, quality assurance data and reports of all external audits conducted on the site).

It is recommended that RMP contains a requirement that the individual annual occupational exposure record includes the following:

1. Unique identification of the individual (e.g. MineHealth surveillance number).
2. The exposure for the current year and, where available, for the relevant five-year period.
3. Results of the measurements for the estimation of the external dose, and methods of assessment.
4. Results of the measurements for the estimation of internal dose (result of personal dust and radon/thoron monitoring), and methods of assessment.
5. The allocated dose for lost or damaged monitors or samples.
6. Any special radiation exposure assigned to the employee.
7. Record of the formal declaration of pregnancy, any revocations of such declaration, and measures taken to ensure that dose to this employee is kept under 1 mSv over the remainder of the pregnancy.

The RMP needs to include a commitment for reporting the results of monitoring programs (both occupational and environmental), and all related information. Reports will be required to the regulatory authority, management, and for the employees, at least on an annual basis. Operational requirements may require more frequent reporting and analysis to management and to the appropriate authority.

For additional guidance in regards to the format of statutory reports and for the levels that, when detected, would typically require investigation please refer to NORM–6 Reporting requirements.

3.12. Dose assessment

The RMP should specify how the results of the monitoring program, detailed in Section 3.10 on page 9, would be used in the assessment of doses of employees.

For new operations, the RMP should include an estimate of the likely doses to be received by the various categories of employees, together with documentation of all assumptions used.

An individual dose assessment should be required for any worker who is normally employed in a controlled area. For any single component of occupational exposure (external and internal) these assessments could be considered if monitoring indicates that annual exposure may exceed 1 mSv, and must be conducted if the estimated dose is likely to exceed 5 mSv per year.

For additional guidance please refer to the NORM–5 Dose assessment.

3.13. Waste management system

The radioactive waste management is an integral part of the RMP and, in some circumstances, a separate document titled Radioactive Waste Management Plan (RWMP) should be developed for the operation.

The nature and extent of information provided in the RMP/RWMP in relation to waste management will depend upon the nature, volume and radioactivity of the wastes and other site-specific factors. For example, if the highest concentration of radionuclides in the waste material at a particular site is in order of several Bq/g and no chemical treatment of mineral takes place, the waste management strategy will be very simple. However, if numerous waste streams are generated at a site using chemical and/or thermal treatment of minerals and concentrations of radionuclides are in order of several tens of Bq/g or above, the separate Radioactive Waste Management Plan will need to be prepared.

The RMP/RWMP should include a summary of the chemical, physical and radiological characteristics and quantity of each of the solid materials and liquid and airborne effluents that may be classified as radioactive waste and will, therefore, require management from a 'radiation perspective'. Examples of such materials include uranium processing tailings, some tailings from processing of different NORM, certain slimes from settling ponds, material collected by the dust extraction systems, scrubber effluents, stack emissions, liquids in discharge pipes and storm sewers, contaminated parts of plant and equipment, scales and sludges from process vessels and pipes, etc.

Most waste generated during mining and processing of NORM contains non-radiological hazardous components similar to those present in waste from other mining and processing activities. In certain cases, chemical toxicity of some of the contaminants in the waste may cause significant environmental impacts when the concentrations of radionuclides are considerably below those that require a special program for the management of this waste from the radiological perspective. It is, therefore, important to ensure that radioactive waste management is an integral part of an overall environmental management program for the particular site.

Waste management system should utilise the best practicable technology and be designed to minimise the release of radioactivity into the environment. All possible pathways for dispersion of radionuclides in the environment should be considered. Initial assessment should include handling, treatment, storage, and disposal of radioactive waste, and it is recommended that following elements are described in detail:

1. Outline of the operation and the processes generating waste.
2. Characterisation of wastes including nature of materials (chemical, physical and radiological), contaminants, and quantities and rates of generation.
3. Detailed characterisation of the environment: climate, terrain, soils, vegetation, hydrology.
4. Heritage (social and cultural), and land use (present, potential and future).

5. Waste management facilities and practices, waste conditioning (where applicable) and containment.
6. Possible discharges: form (gas, liquid or solid), discharge and release criteria.
7. Contingency measures for natural events, incidents, equipment and operational failures, temporary cessation of operations.
8. Monitoring programs, assessments of results and reporting.
9. The need for restricted release zones.
10. Outline of the proposed closure plan for the site, including decommissioning, decontamination and rehabilitation concepts, proposals for long-term surveillance and reporting, records management, institutional controls (where required), and the description of possible future caveats to land use (please refer to Section 2.3.5. Contaminated Sites of the guideline NORM–4.2 Management of radioactive waste for more information).

When all characteristics of each potentially radioactive waste stream are known, the specific management strategy should be described for each material, including (in addition to the list above):

1. The facilities and procedures, including control technologies used in handling and treatment of the waste.
2. Monitoring program, including the specific radiation parameters to be measured and any independent audits undertaken.
3. In the case of final disposal in a specifically designed facility (such as for the disposal of tailings from a uranium or rare earth processing plant) include:

    a) information on the design, operation and expected performance capability of the disposal facility and its exact location;

    b) techniques to be used for the disposal, such as method of deposition, tails conditioning, dam lining, depth of cover, cover material;

    c) the possibility for leaching of radionuclides, potential for their off-site migration and procedures to prevent this process;

    d) institutional controls to be implemented, such as long-term monitoring and record-keeping; and

    e) an exact amount of material disposed in the facility, its radiological characteristics and description of other hazards associated with the particular waste.

The RMP/RWMP should include suitable diagrams and maps/plans to describe the design and location of storage or disposal facilities and the location of restricted release zones.

In order to ensure that in the long term the use of the disposal site is not restricted, Mines Safety and Inspection Regulation 16.35 (2) requires that, so far as is practicable, radioactive waste is diluted with other mined material before it is disposed of.

It is important that the blending of materials is carried out with caution, particularly in cases when the material to be diluted was a subject to a chemical and/or thermal processing and mobility of some radionuclides may have increased in comparison with the material's original state. A formal approval by the appropriate authority is required before any blending of materials commences, and systems must be in place to ensure that dilution process is carried out in accordance with any special conditions that may be imposed by the appropriate authority.

The blending of radioactive waste with other mined material is typically practical only in cases where no chemical and/or thermal treatment of mineral has taken place and radionuclides in both uranium and thorium decay chains are in the state of secular equilibrium. Limited blending options

are available for all other waste material and typical conditions are that if the blended waste is not disposed of, its re-use is limited to the applications where public exposures will be negligible, for example – as a construction material for sea walls and artificial reefs around industrial ports. In these cases it will still be necessary that all radionuclides are stabilised within concrete and no measurable leaching of elements like uranium and radium into the sea water occurs.

Some aspects of waste management would have already been addressed during the formal environmental approval process and in many cases it would be sufficient to simply reference the appropriate sections of the environmental impact assessment and other relevant documents. Similarly, facilities for tailings storage and/or disposal are, as a rule, licensed in accordance with relevant legislation and are subject to periodic engineering performance assessments.

In some cases when, several years after the closure of a disposal facility, it is known that radioactivity levels in waste materials are low and radionuclides are very unlikely to leach into the ground water (for example, in mineral sands mining), a long-term radiation monitoring program for a particular disposal site can be significantly reduced and consist mainly of erosion monitoring.

3.14. Transport of radioactive materials

The RMP should include a detailed description of procedures for transport of radioactive materials, including the:

- types of packaging (where applicable) and signposting;
- details of mode of transport and containers;
- number of employees involved in transport and their estimated exposure times and doses;
- amounts and radioactivity content of transported materials, frequency of transport movements;
- transport routes, estimates of potential exposure of members of the general public and the environment in the course of normal operations and in case of transport accidents (specific emergency response procedures should also be developed); and
- summary of operational procedures, particularly illustrating measures taken to ensure strict compliance with transport safety regulations.

For additional guidance please refer to the guideline NORM–4.3 Transport of NORM.

3.15. Radiation safety resources

The RMP should describe the management and reporting structure for the particular site, and the duties and qualifications of relevant personal and, in particular, the radiation safety officer. The RMP should also include a clear commitment to provide adequate staff with appropriate qualifications and experience, to advise the management on all aspects of radiation protection on the site.

The RMP should also list the monitoring equipment and support facilities, including the:

- make and model of the equipment;
- purpose of the particular instrument and its applicability for the particular purpose;
- calibration methods and frequency, and traceability to the National Standard; and
- maintenance and replacement schedule.

3.16. List of commitments

The final section of the RMP should summarise all the commitments made throughout the document, with references to their location within the RMP.

3.17. Examples of figures and tables to be included in the Radiation Management Plan

The following examples are provided to illustrate the type of figures and tables that could be included in the RMP to enhance the presentation of specific information.

3.17.1. Figures

The figures should include:

1. General location diagram of operations/facilities.
2. Map/plan of the site, showing layout of infrastructure in relation to the tenement boundaries and the national grid.
3. Location of critical groups of the public.
4. Diagrams of waste disposal facilities, showing relevant engineering details.
5. Diagrams showing location and details of engineering control equipment used during various stages of operations.
6. Maps/plans showing locations of supervised, controlled and restricted areas.
7. Diagram showing process flows with particular attention paid to potentially radioactive streams.
8. Examples of warning signs used on site and their locations.

3.17.2. Tables

The tables should include:

1. A summary of site history.
2. The workforce stratification information, including shift patterns.
3. A summary of sources/pathways of radiation exposure.
4. The radionuclide mass balance.
5. The radiation monitoring program.
6. A list of radiation monitoring equipment.
7. A list of radiation gauges (density, in-stream analysers, etc.) and their locations.
8. A summary of dose estimation calculations, by work category and exposure pathway.
9. The outline of employee induction programs.

It is recommended that typical results obtained during routine monitoring be included in the form of tables and charts. Where special forms associated with the RMP have been developed (such as, for example, a ‘clearance form’ for the removal of potentially contaminated equipment from the site, or

a ‘controlled area entry permit’), it is recommended to provide an example of a completed document instead of the blank form.

It is also useful to compile a special radiation protection standard job procedures manual (so all relevant work instructions are available in one document) and submit it to the appropriate authority as an appendix or a supplement to the RMP.

A. Appendix showing a Radiation Management Plan checklist

	Standard	Intent	MSIR Regulation [1]	Mining Code [3]	✓
1	Front cover				
	Controlled document	To verify that proper control of documentation is in place.	Reg. 16.7(3)	Sec. 3.8.3	
	Each page dated and identified	To verify unauthorised changes cannot be made to the RMP.	Reg. 16.7(6)	Sec. 2.9.6	
	Title of document	To verify that the document submitted is the RMP.	Reg. 16.7(1)	Sec. 2.7.1.	
	Reference number of document	To verify the RMP is stored in a records management system.	Reg. 16.25	Sec. 2.7.2(e)	
	Date of issue	To verify the RMP is current and reviewed every 2 years.	Reg. 16.7(4)	Sec. 2.9.6	
	Date of submission	To verify the RMP has been provided to the State Mining Engineer.	Reg. 16.7(3)	Sec. 2.9.6	
	Name of Company	To verify owner of the RMP.	Reg. 16.7	Sec. 2.10.1	
	Name of Operation	To verify site where RMP is implemented.	Reg. 16.7	Sec. 2.10.1	
	Endorsed by Registered Manager	To verify that the responsible person has complied.	Reg. 16.7	Sec. 2.10.1	
2	Scope				
	Details of operations and facilities	To verify the the size and scope of the operations.	Reg. 16.8(2)	Sec. 2.7.2	
	Details of location	To verify the exact location of the site.	Reg. 16.7	Sec. 2.7.2	
	Details of Lease or Tenement	To verify the site location under the Mining Act.	Reg. 16.7	Sec. 2.7.2	
3	Introduction				
	History of site or ownership	To verify current RMP includes previous records or plans.	Reg. 16.25	Sec. 3.8.1(f)	
	Reason for Radiation Management Plan	To verify a RMP is required.	Reg. 16.2	Sec. 2.7.1	
	Mining/processing activities on site	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.3.2	

	Standard	Intent	MSIR Regulation [1]	Mining Code [3]	✓
	Type of mine/processing plant	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.1	
	Expected duration of operations	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.1	
	Critical project dates	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.1	
	Block diagrams of functional activities	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.2	
	Process flow-sheets	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.2	
4	Workforce				
	Number of persons employed	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.2(b)	
	Stratification - employees/contractors & gender	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.10.1(m) (p)	
	Work categories	To verify use of appropriate equipment, facilities and operational procedures.	Reg.16.7(2)(a)(i)	Sec. 3.6.7	
	Roster system	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.2(b	
	Average working hours	To verify use of appropriate equipment, facilities and operational procedures.	Reg.16.7(2)(a)(i)	Sec. 2.7.2(b	
	Designated employees	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.2(b	
	Radiation exposures	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.2(b	
5	Critical groups				
	Identification	To verify that members of the public are not exposed to radiation from the operation.	Reg. 16.9	Sec. 2.8.2(c)	
	Location	To verify that members of the public are not exposed to radiation from the operation.	Reg. 16.9	Sec. 2.8.2(e)	
	Size	To verify that members of the public are not exposed to radiation from the operation.	Reg. 16.9	Sec. 2.8.2(e)	

	Standard	Intent	MSIR Regulation [1]	Mining Code [3]	✓
	Demographics	To verify that members of the public are not exposed to radiation from the operation.	Reg. 16.9	Sec. 2.8.2(e)	
	Land-use maps	To verify that members of the public are not exposed to radiation from the operation.	Reg. 16.9	Sec. 2.8.2(e)	
	Location plan or map	To verify that members of the public are not exposed to radiation from the operation.	Reg. 16.9	Sec. 2.8.2(e)	
	Radiation exposures	To verify that members of the public are not exposed to radiation from the operation.	Reg. 16.9	Sec. 2.8.2(e)	
6	Sources & pathways of radiation exposure				
	Identified sources & pathways	To verify that adequate monitoring programs are in place.	Reg. 16.7(2)(a)(ii)	Sec. 3.8.1(a)	
	Plans of mines/processing plant	To verify that adequate monitoring programs are in place.	Reg. 16.7(2)(a)(ii)	Sec. 2.8.1(a)	
	Descriptions of equipment	To verify that adequate monitoring programs are in place.	Reg. 16.7(2)(a)(ii)	Sec. 2.8.2	
	Processes involved	To verify that adequate monitoring programs are in place.	Reg. 16.7(2)(a)(ii)	Sec. 2.8.2(a)	
	Risk assessments	To verify that adequate monitoring programs are in place.	Reg. 16.7(2)(a)(ii)	Sec. 2.8.2(d)	
	Process streams	To verify waste management system.	Reg. 16.7(2)(c)	Sec. 2.8.2(d)	
	Radionuclide concentrations	To verify that adequate monitoring programs are in place.	Reg. 16.7(2)(a)(ii)	Sec. 2.8.2(d)	
	Radionuclide balances	To verify waste management system.	Reg. 16.7(2)(c)	Sec. 2.8.2(d)	
	Inputs/outputs	To verify waste management system.	Reg. 16.7(2)(c)	Sec. 2.8.2(d)	
	Accumulation of radioactive scales/sludges	To verify waste management system.	Reg. 16.7(2)(c)	Sec. 2.8.2(d)	
	Scientific justification, models, data	To verify that the best practicable technology is incorporated on site.	Reg. 16.7(5)	Sec. 2.8.2(d)	
	List of radiation gauges/x-ray equipment	To verify sealed radiation sources and irradiating apparatus.	Reg. 16.38	Sec. 2.7.2(e)	

	Standard	Intent	MSIR Regulation [1]	Mining Code [3]	✓
7	Control of radiation exposure				
	Measures implemented	To verify measures to keep employee doses as low as practicable.	Reg. 16.15	Sec. 3.8.1(b)	
	Engineering controls, methods and specifications	To verify that the best practicable technology is incorporated on site.	Reg. 16.15	Sec. 3.8.1(b) Sec. 3.9.1	
	Ventilation controls	To verify that the best practicable technology is incorporated on site.	Reg. 16.7(5)	Sec. 2.6.2 Sec. 3.8.1(b)	
	Dust controls	To verify measures to keep employee doses as low as practicable.	Reg. 16.15	Sec. 2.6.2 Sec. 3.8.1(b)	
	Fume controls	To verify dust suppression is being used.	Reg. 16.7(2)(a)(i)	Sec. 2.6.2 Sec. 3.8.1(b)	
	Shielding	To verify measures to keep employee doses as low as practicable.	Reg. 16.7(2)(a)(i)	Sec. 2.6.2 Sec. 3.8.1(b)	
	Processing equipment controls	To verify that the best practicable technology is incorporated on site.	Reg. 16.7(2)(a)(i)	Sec. 2.6.2 Sec. 3.8.1(b)	
	Exposure minimisation techniques	To verify measures to keep employee doses as low as practicable.	Reg. 16.7(2)(a)(i)	Sec. 2.6.2 Sec. 3.8.1(b)	
	Plans of plant layout		Reg. 16.25(1)(d)	Sec. 3.7.2(a)	
	Housekeeping measures	To verify measures to keep employee doses as low as practicable.	Reg. 16.7(2)(a)(i)	Sec. 2.6.2 Sec. 3.7.2(a)	
	Contamination control	To verify use restricted release zones.	Reg. 16.7(2)(c)(i)	Sec. 2.6.2	
	Spillage control	To verify that the best practicable technology is incorporated on site.	Reg. 16.7(5)	Sec. 2.6.2	
	Diagrams of occupied workplaces in relation to radiation levels or radioactive mineral streams	To verify measures to keep employee doses as low as practicable.	Reg. 16.15	Sec. 3.7.2(a)	
	Controlled areas	To verify waste management system.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Exhaust stacks, bag house dust collectors	To verify waste management system.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Storm-water discharge	To verify waste management system.	Reg. 16.7(2)(c)	Sec. 3.9.1	
8	Institutional controls				

	Standard	Intent	MSIR Regulation [1]	Mining Code [3]	✓
	Responsibilities of personnel	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.10.1	
	Accountability	To verify that the manger is advised on matters to do with implementing RMP.	Reg. 16.9(3)	Sec. 3.10.1	
	Commitment	To verify manager is committed to implementing the RMP.	Reg. 16.8(1)	Sec. 2.8.2(a)	
	Radiation Safety Officer/Licence	To verify that a appropriate RSO has been appointed.	Reg. 16.8	Sec. 2.10.1(d)	
	Designation of supervised, controlled and restricted areas	To verify doses are being controlled.	Reg.16.16	Sec. 2.10.1(m)	
	Housekeeping measures	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.6.2	
	Preventative maintenance, measures, schedules	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.6.2	
	Operating procedures	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.10.1(a)	
	Emergency planning	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.2(f)	
	Personal protective equipment	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.2(c)	
	Inspection and auditing programs	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.8.3(b)	
	Controlled area work rules	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.8.1(b)	
	Signage	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.10.2	
	Personal hygiene rules	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.10.2	
	Job rotation	To verify doses are kept as low as practicable.	Reg. 16.15	Sec. 3.8.1(b)	
9	Employee training				

	Standard	Intent	MSIR Regulation [1]	Mining Code [3]	✓
	Induction program	To verify the instruction and training program.	Reg. 16.7(2)(a)(v)	Sec. 2.7.2(d) Sec. 3.8.1(e)	
	Periodic re-training	To verify the instruction and training program.	Reg. 16.7(2)(a)(v)	Sec. 2.7.2(d) Sec. 3.8.1(e)	
	Radiation safety training of personnel	To verify the instruction and training program.	Reg. 16.7(2)(a)(v)	Sec. 2.7.2(d) Sec. 3.8.1(e)	
	Details of person giving training	To verify the instruction and training program.	Reg. 16.7(2)(a)(v)	Sec. 2.7.2(a) Sec. 3.8.1(e)	
	Syllabus	To verify the instruction and training program.	Reg. 16.7(2)(a)(v)	Sec. 2.7.2(a) Sec. 3.8.1(e)	
10	Radiation monitoring program				
	Compliance with limits	To verify radiation dose is kept as low as practicable.	Reg. 16.15	Sec. 3.8.1(c)	
	Exposure to employees and public	To verify radiation dose is kept as low as practicable.	Reg. 16.15	Sec. 3.8.1(c)	
	Impact of operations on environment	To verify environmental radiation monitoring program.	Reg. 16.6	Sec. 3.8.1(c)	
	Effectiveness of controls	To verify radiation dose is kept as low as practicable.	Reg. 16.15	Sec. 3.8.1(c)	
	Employees monitored	To verify radiation dose is kept as low as practicable.	Reg. 16.15	Sec. 3.8.1(c)	
	Type of monitoring and sampling	To verify adequacy of monitoring program.	Reg. 16.7(2)(ii)	Sec. 3.8.1(c)	
	Duration	To verify adequacy of monitoring program.	Reg. 16.7(2)(ii)	Sec. 3.8.1(c)	
	Frequency	To verify adequacy of monitoring program.	Reg. 16.7(2)(ii)	Sec. 3.8.1(c)	
	Sampling equipment	To verify adequacy of equipment.	Reg. 16.8(2)	Sec. 2.7.2(c)	
	Calibration records of all equipment	To verify monitoring equipment is being maintained.	Reg. 16.8(3)	Sec. 3.8.3(a)	
	Analysis methods	To verify procedures for the assessment of dose.	Reg. 16.7(2)iii	Sec. 3.8.1(c)	
	Radiation types monitored	To verify adequacy of monitoring program.	Reg. 16.7(2)(ii)	Sec. 3.8.1(c)	

	Standard	Intent	MSIR Regulation [1]	Mining Code [3]	✓
	Radionuclides	To verify adequacy of monitoring program.	Reg. 16.7(2)(ii)	Sec. 3.8.1(c)	
	Surface contamination	To verify adequacy of monitoring program.	Reg. 16.7(2)(ii)	Sec. 3.8.1(c)	
	Radon/Thoron dose estima-tions/measurements	To verify procedures for the assessment of dose.	Reg. 16.7(2)iii	Sec. 3.8.1(c)	
	Equipment specifications	To verify that the best practicable technology is available.	Reg. 16.7(5)	Sec. 2.7.2(c)	
	Training and experience of personnel	To verify adequacy of staff .	Reg. 16.8(2)	Sec. 2.7.2(a)	
	Calibration and traceability of results/schedules including Australian Standards	To verify monitoring equipment is being maintained.	Reg. 16.8(3)	Sec. 3.8.3(a)	
	Audits – internal and external	To verify adequacy of monitoring program.	Reg. 16.7(2)(ii)	Sec. 3.8.3(b)	
	Quality assurance program which is compliant with Australian Standards.	To verify adequacy of monitoring program.	Reg. 16.7(2)(ii)	Sec. 3.8.3	
11	Records management & reporting				
	Information on radiological conditions	To verify that appropriate records are being kept under the RMP.	Reg. 16.25(1)(d)	Sec. 2.7.2(e)	
	Assessments of exposures	To verify that records are being kept of dose assessments.	Reg. 16.25(1)(a)	Sec. 2.10.1(n) Sec. 2.10.1(o)	
	Impact on local environment	To verify that appropriate records are being kept under the RMP.	Reg. 16.25(1)(d)	Sec. 2.10.1(n)	
	Relevant documentation	To verify that appropriate records are being kept under the RMP .	Reg. 16.25(1)(d)	Sec. 2.7.2(e)	
	Identification of individuals	To verify that monitoring records are being kept .	Reg. 16.25(1)(b)	Sec. 3.8.1(f)	
	Easy, secure long term access to data	To verify that appropriate records are being kept under the RMP .	Reg. 16.25(5)	Sec. 3.8.1(f)	
	Reporting to the State Mining Engineer	To verify that results from the monitoring program and waste management plan are reported to SME.	Reg. 16.26	Sec. 2.10.1(g)(i) (j)(h)	

	Standard	Intent	MSIR Regulation [1]	Mining Code [3]	✓
12	Dose assessment				
	Methodology for exposure calculations	To verify the use of appropriate procedures for the assessment of dose.	Reg. 16.7(2)(a)(iii)	Sec. 2.7.2(b) Sec. 2.8.1(d)	
13	Waste management				
	Pre-operational monitoring program	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.6	Sec. 2.8.2(b) Sec. 3.9.1	
	Nature of waste	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Volume of waste	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Radioactivity of waste	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Outline of processes generating waste	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Characterisation of wastes	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Characterisation of environment	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Heritage and land use	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Waste management facilities	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Waste management practices	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Waste conditioning	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Contingency measures	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Monitoring program	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Assessment of monitoring results	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	

	Standard	Intent	MSIR Regulation [1]	Mining Code [3]	✓
	Reporting	To verify reporting on waste management system.	Reg 16.26(b)	Sec. 3.9.1	
	Restricted release zones	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)(i)	Sec. 3.9.1	
	Decommissioning plan	To verify use of appropriate equipment, facilities and operational procedures.	16.35(1)(a)	Sec. 3.9.1	
	Rehabilitation and closure criteria	To verify use of appropriate equipment, facilities and operational procedures.	16.35(1)(a)	Sec. 3.9.1	
	Long-term surveillance and reporting	To verify use of appropriate equipment, facilities and operational procedures.	16.35(1)(a)	Sec. 3.9.1	
	Control technologies	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.9.1	
	Handling and treatment of waste	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.9.1	
	Independent audits	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.9.1	
	Disposal techniques	To verify waste management system.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Leachability of radionuclides	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
	Hazards of wastes	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(c)	Sec. 3.9.1	
14	Transport				
	Types of packaging	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.8.1(b)	
	Signposting	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.8.1(b)	
	Details of transport mode and containers	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.8.1(b)	
	Numbers of employees involved	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.8.1(b)	

	Standard	Intent	MSIR Regulation [1]	Mining Code [3]	✓
	Estimates of exposures and doses need to be provided in order to judge the adequacy of control measures.	To verify adequacy of monitoring program .	Reg. 16.7(2)(ii)	Sec. 3.8.1(b)	
	Amounts of radioactivity (per package & annual)	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.8.1(b)	
	Frequency and transport movements	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.8.1(b)	
	Transport routes	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.8.1(b)	
	Operational procedures	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 3.8.1(b)	
	Emergency procedures	To verify the use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.2 (f)	
15	Radiation safety resources				
	Lists of equipment and facilities	To verify use of appropriate equipment, facilities and operational procedures.	Reg. 16.7(2)(a)(i)	Sec. 2.7.2(c)	
	The name and qualifications of the RSO and list of people involved in monitoring	To verify use of appropriate equipment, facilities and operational procedures .	Reg. 16.7(2)(a)(i)	Sec. 2.7.2(a)	
16	List of commitments				
	Commitments clearly laid out	To verify that the responsible person will ensure the RMP is complied with.	Reg. 16.8(1)	Sec. 2.7.1	
17	Glossary				
	Lists of word meanings	To verify the meanings of the terms used in RMP	Reg. 16.7(2)(a)(i)	Sec. 2.3.4	

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