Vimy Resources Limited

Above Ground Tailings Storage Facility Monitoring and Management Plan

(Outcome-Based Condition Environmental Management Plan)

Mulga Rock Uranium Project

EMP-EHS-009

Version 2 Revised 14 January 2021

Document Control:

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				Name	Signature
A	28/12/2016	Paula Arthur	Adam Pratt	-	-
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0	26/02/2018	Paula Arthur	Adam Pratt	Julian Tapp	
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Summary

Title of proposal	Mulga Rock Uranium Project (MRUP)
Proponent name	Vimy Resources Limited
Ministerial Statement Number	1046
Purpose of this EMP	The Above Ground Tailings Storage Facility Monitoring and Management Plan is submitted to fulfil the requirements of Conditions 6 and 16 of the above Statement.
EPA's environmental objective for the key environmental factor/s	Terrestrial Environmental Quality To maintain the quality of land and soils so that environmental values are protected.
Condition environmental outcome or proposed measurable outcome	1) Ensure that the above ground Tailings Storage Facility is safe to members of the public and non-human biota, geo-technically and geomorphologically stable, and geo chemically non-polluting.
Key provisions	**Trigger Criterion 1**: Annual (average over 5 years) total dose after rehabilitation ≥ 0.3 mSv/yr above natural background level. **Threshold Criterion 1**: Annual (average over 5 years) total dose after rehabilitation ≥ 1 mSv/yr above natural background level.
	Trigger Criterion 2: Depositional dust from the rehabilitated TSF ≥ 2.0 g/m^2/month above background (annual average). **Threshold Criterion 2**: Depositional dust from the rehabilitated TSF ≥ 4.0 g/m^2/month above background (annual average).
	Trigger Criterion 3: Gulley formation has created a gulley ≥ 50cm. **Threshold Criterion 3**: Gulley formation has created a gulley ≥ 100cm.
	Trigger Criterion 4: Biennial revision of Landform Evolution Modelling (LEM). **Threshold Criterion 4**: Triennial revision of Landform Evolution Modelling (LEM).
	Trigger Criterion 5: Revegetation growth not apparent 2 years after rehabilitation earthworks completed. **Threshold Criterion 5**: Revegetation growth not appearing to meet rehabilitation criteria 4 years after rehabilitation earthworks completed.
	Trigger Criterion 6: Rehabilitation does not achieve ≥ 50% of the completion criteria for species richness, plant density and foliage cover within 5 years after revegetation works completed. **Threshold Criterion 6**: Rehabilitation does not achieve ≥ 30% of the completion criteria for species richness, plant density and foliage cover within 5 years after revegetation works completed.
	Trigger Criterion 7: Groundwater quality (as measured by pH, TDS and key metal ion concentrations {Zn, Ni, CU, Co, U – in mg/L}) ≥ 1.65 standard deviations different from background groundwater concentrations at the location of the 'Above Ground TSF Monitoring Bores' for three or more consecutive monitoring periods (a monitoring period is three months). Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.

	Threshold Criterion 7: Groundwater quality (as measured by pH, TDS and key metal ion concentrations {Zn, Ni, CU, Co, U – in mg/L}) ≥ 2 standard deviations different from background groundwater concentrations at the location of the 'Above Ground TSF Monitoring Bores' for three or more consecutive monitoring periods (a monitoring period is three months). Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.

1. Context, Scope and Rationale

1.1 Proposal

Vimy Resources Limited (Vimy) proposes to develop the Mulga Rock Uranium Project (MRUP or the Project) which lies approximately 240km east-northeast of Kalgoorlie-Boulder in the Shire of Menzies. The area is remote, located on the western flank of the Great Victoria Desert, comprising series of large, generally parallel sand dunes, with inter-dunal swales and broad flat plains.

The MRUP covers approximately 102,000 hectares on granted mining tenure (primarily M39/1104 and M39/1105) within Unallocated Crown Land (UCL). It includes two distinct mining centres, Mulga Rock East (MRE) comprising the Princess and Ambassador deposits and Mulga Rock West (MRW) comprising the Emperor and Shogun deposits, which are approximately 20km apart. The deposits will be mined using large-scale open pits to produce an annualised peak capacity of 2,180 t/a (4.8 Mlbs) U_3O_8.

The anticipated Life-of-Mine (LOM) is up to 16 years, based on the currently identified resource.

This Condition Environment Management Plan (CEMP) has been written in accordance with the *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans* (EPA, 2016).

1.2 Key Environmental Factor/s

This Above Ground Tailings Storage Facility Monitoring and Management Plan specifically addresses the Terrestrial Environmental Quality environmental factor, which is part of the overall Land theme.

The MRUP will result in the generation of a tailings product which may be stored in an above ground tailings storage facility (TSF). This storage facility will be designed, constructed, operated, decommissioned, rehabilitated and closed in accordance with the following standards to ensure the long-term safety to members of the public and non-human biota, and that the TSF is geotechnically and geomorphologically stable, and is geochemically non-polluting:

- DME (1998). Guidelines on the Development of an Operating Manual for Tailings Storage.
- DME (1999). Guidelines on the Safe Design and Operating Standards for Tailings Storage.
- DMP (2013) Tailings Storage Facilities in Western Australia: Code of Practice.
- ANCOLD (2012). Guidelines on tailings dams - Planning, design, construction, operation and closure.
- ICOLD (2013). Bulletin 153 – Sustainable design and post-closure performance of tailings dams.
- ICOLD (2011). Bulletin 139 – Improving tailings dam safety - Critical aspects of management, design, operation and closure.
- ICOLD (1996). Bulletin 106 – A guide to tailings dams and impoundments - Design, construction, use and rehabilitation.

The Above Ground TSF will be a double-lined facility (mostly layers of compacted clay but will include HDPE liners on batters) with underdrainage and a leak detection system. The underdrainage system will comprise sand filters and free drainage sand and seepage collection and recovery pipes. The leak detection system will be placed between the double layers and any seepage will be collected and recirculated back into the TSF. Whilst the facility will adhere to the above standards and best-practice, the following risks have been identified based on a source-pathway-receptor model:

Impact Group	Risk
Members of the Public	Radiological dose from the stored and / or released tailings
Non-human biota	Radiological dose from the stored and / or released tailings
	Dust – radiological dose & physical / chemical impact
Terrestrial Environmental Quality	Dust – physical / chemical impact
	Excessive erosion and sediment deposition
	Contaminated water seepage
	Engineered containment is inadequate

This CEMP provides specific Environmental Criteria (Trigger and Threshold Criteria) and Response Actions (Trigger Level and Threshold Contingency Actions) to provide long-term protection for the above impact groups against the identified risks.

1.3 Condition requirements

Condition	Section in Condition EMP
16-1 The proponent shall manage the implementation of the Proposal to meet the following environmental outcome using the best available landform modelling over 10,000 years post mine closure: 1) Ensure that the above ground Tailings Storage Facility is safe to members of the public and non-human biota, geo-technically and geomorphologically stable, and geo chemically non-polluting.	Whole document
16-2 The proponent shall consult with the Department of Mines and Petroleum in the preparation of the Above Ground Tailings Storage Facility Monitoring and Management Plan required by condition 6-1 that satisfies the requirements of condition 6-2, to meet the outcome required by condition 16-1.	Section 4
16-3 The Above Ground Tailings Storage Facility Monitoring and Management Plan required by condition 6-1 shall include provisions required by condition 6-2 to: 1) Update the Landform Evolution Modelling and intervals not exceeding the three (3) years, or as otherwise specified by the CEO, using digital elevation modelling data suited to the extent of the modelled area and consistent with best practice; and 2) Detail appropriate rehabilitation measures, including but not limited to timely trials for the revegetation of the tailings storage facility, where required.	Section 2
16-4 The proponent shall continue to implement the Above Ground Tailing Storage Facility Monitoring and Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition 6-1 satisfied the requirements of condition 6-2 to meet the outcome required by condition 16-1.	Whole document

The key aspect of geochemical stability (i.e. non-polluting) is explicitly addressed in Condition 15-1 (3) and 15-3 and the associated outcome-based Tailings Storage Facility Monitoring and Management Plan; it therefore not covered in this CEMP.

1.4 Rationale and approach

1.4.1 Survey and study findings

Tailings will be generated as a by-product from the processing of the lignite-hosted uranium-bearing ore. Processing will involve the following stages:

- Beneficiation of the ore to remove sand (quartz) particles using conventional gravity / screening techniques;
- Milling (to 150µm);
- Extraction of the uranium from the ore using H_2SO_4;
- Capturing the released uranium using Resin-In-Pulp;
- Stripping of uranium from the loaded resin; and
- Uranium conditioning (nano-filtration, precipitation, drying, packaging).

Extensive tailings characterisation, stability analysis and radionuclide deportment testing has been completed as part of the PER (Vimy, 2015) and for the Definitive Feasibility Study (DFS) piloting program for the processing plant.

Radiological properties

Typical radiological properties of the tailings solids and liquor are summarised below:

Parameter	Unit	Value (average)
Tailings solids		
Uranium		
U content	mg/kg (%)	201 (0.02%)
U_3O_8 content	mg/kg (%)	237 (0.024%)
Activity (U-238)[1]	Bq U-238/g	2.51
Gamma dose rate	µSv/hr	0.84
Thorium		
Th content	mg/kg (%)	42 (0.0042)
ThO_2 content	mg/kg (%)	48 (0.0048)
Activity (Th-232)[1]	Bq Th-232/g	0.192
Gamma dose rate	µSv/hr	0.077
Radon emanation rate		
Estimated from U_3O_8 content[2]	Bq/m²/s	1.18
Measured on actual tailings[3]	Bq/m²/s	0.36
Thoron emanation rate Estimated from ThO_2 content[4]	Bq/m2/s	16.17
Radionuclide composition - solids		
Th-230	Bq/g	8.2
Ra-226	Bq/g	7.7
Pb-210	Bq/g	7.6
Po-210	Bq/g	6.3
U-235	Bq/g	0.09
Ac-227	Bq/g	0.33
Th-232/228	Bq/g	0.11

Parameter	Unit	Value (average)
Tailings liquor		
U content	mg/L	51
Th content	mg/L	3.2
Radionuclide composition - liquor		
Th-230	Bq/L	<2.0
Ra-226	Bq/L	3.5
Pb-210	Bq/L	36
Po-210	Bq/L	0.0
U-235	Bq/L	3.7
Ac-227	Bq/L	36
Th-232/228	Bq/L	<0.10

[1] Based on: 1% U = 125 Bq U-238/g and 1% Th = 40Bq Th-232/g; [2] Based on a conservative value of 1% U3O8 = 49 Bq/m^2/s – a more realistic relationship is 1% U_3O_8 = 18 Bq/m^2/s; [3] Difference between measured radon emanation rate and estimated rate is likely due to the disequilibrium in the U-238 chain, with the Ra-226 activity being considerably less that the uranium activity; [4] Based on a conversion factor of 3,850Bq/m^2/s per % Th.

Figure 1 (Cothern *et al* 1987; Chambers 2009) shows the attenuation of radon through a cover system; actual measurements on site have found that a 30cm clay cover is sufficient to decrease radon emanation rates by more than 50%. During rehabilitation and closure of the above-ground TSF, the tailings surface will be covered by a 1m thick capillary break to prevent the upward migration of saline liquor, 1m of clay to act as a radon penetration barrier and then at least 2m of cover material derived from mining overburden (collectively shaped to shed rainfall without erosion), topped with a layer of growth medium sufficient to support the desired end land use or revegetation species. The vegetation used will be determined by revegetation trials, some of which are currently underway (at the site of the Geotechnical Investigation Trenches (GITs)). Covering of the tailings with at least 4m of material will significantly reduce any radon (Rn-222) or thoron (Rn-220) releases as the half-life of radon and thoron is so low (3.8 days and 55 seconds) that it has decayed substantially (and has effectively gone) before it permeates through the cover system.

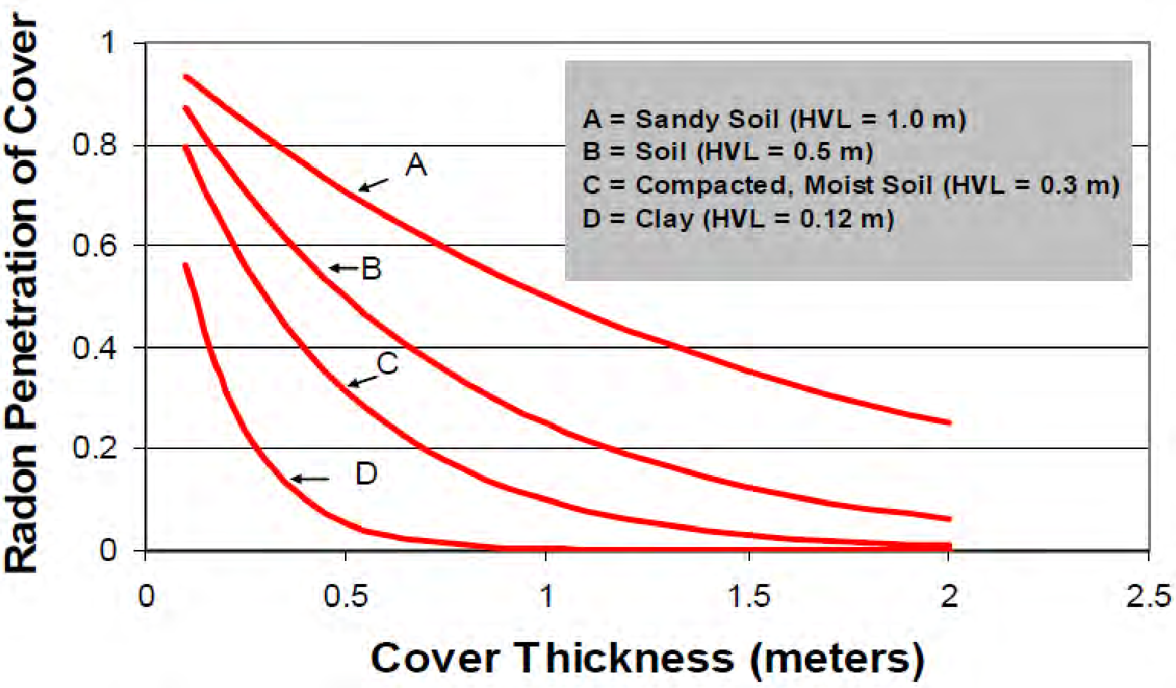

Figure 1: Attenuation of radon through a cover system (HVL = cover thickness)

The cover system over the tailings will prevent, providing it is stable and not erodible, the exposure of the tailings surface after closure. Consequently, the risks from long-lived alpha particles are negated, and it is only the short-lived alpha radionuclides associated with radon and thoron, and their respective daughter products that are an issue, although their very short half-lives and appreciable thickness of the cover, effectively removes this risk also.

Dust

Background dust levels across the MRUP have been measured since 2012 using:

- Dust Deposition Gauges (DDG): 18 DDG's located providing quarterly measurements of Total Insoluble Matter.
- High Volume Sampler (HVS): located at the current camp providing continuous PM10 concentration readings since 2012.

The results from the DDG and HVS are plotted in Figure 2 to Figure 5. These results show that overall, dust levels across the MRUP are relatively low with annual average total dust levels typically <2g/m^2/mth and PM10 particulate concentration levels typically well below 50µg/m^3, with only 17days since May 2012 (<1%) exceeding the NEPM PM10 standard.

These low dust levels are expected given the dominantly sandy nature of the surface soils, and elevated dust levels are only associated with large regional-scale bushfires (like which occurred in November 2014; Figure 2).

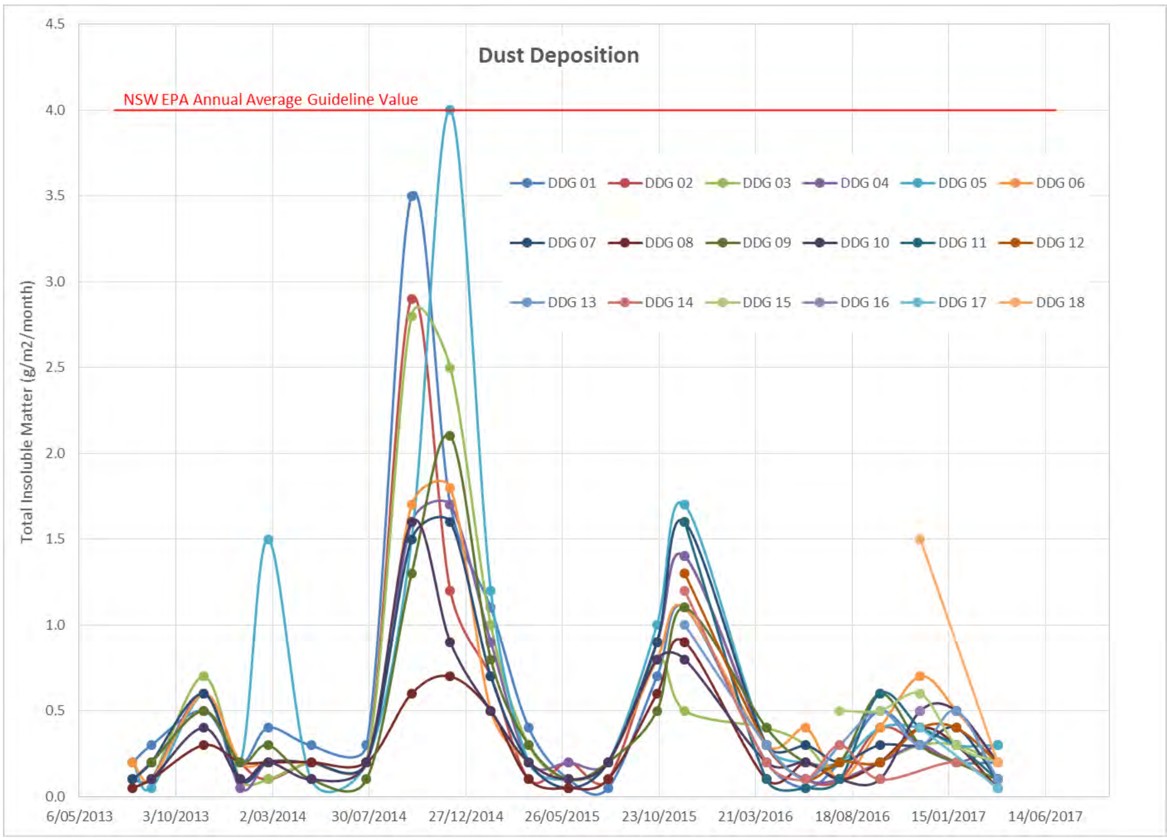

Figure 2: Measured dust deposition across the MRUP

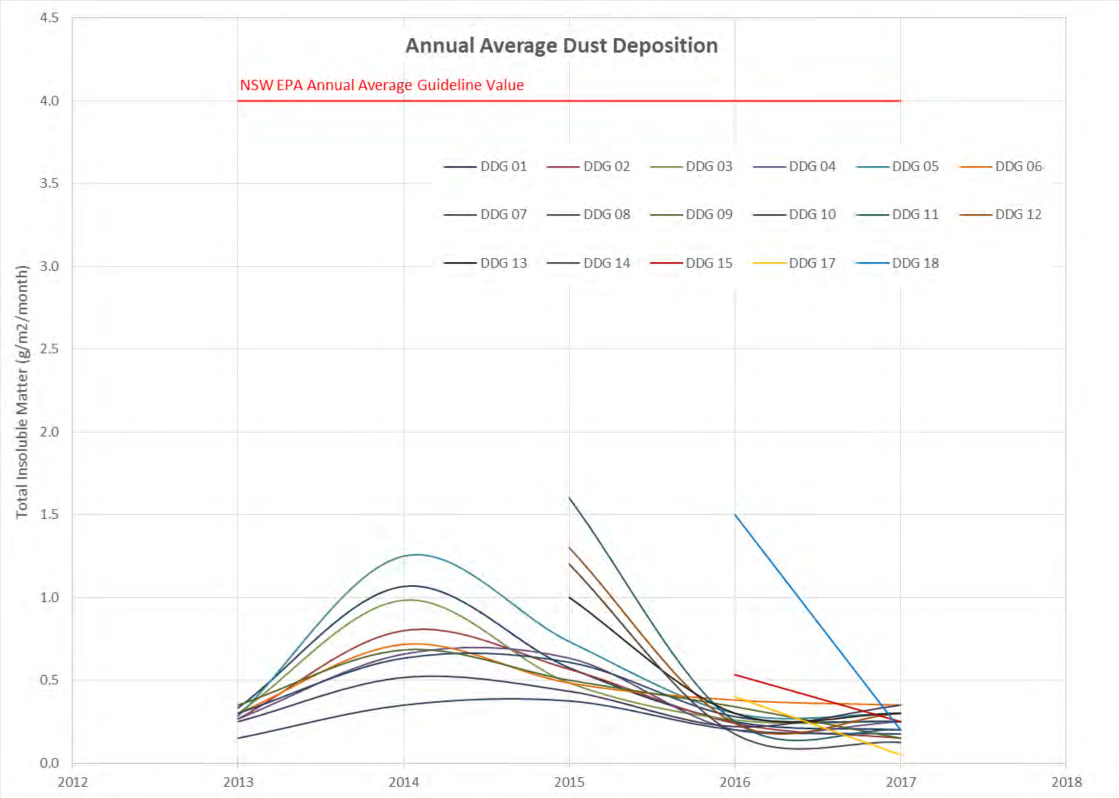

Figure 3: Annual average dust deposition for the MRUP

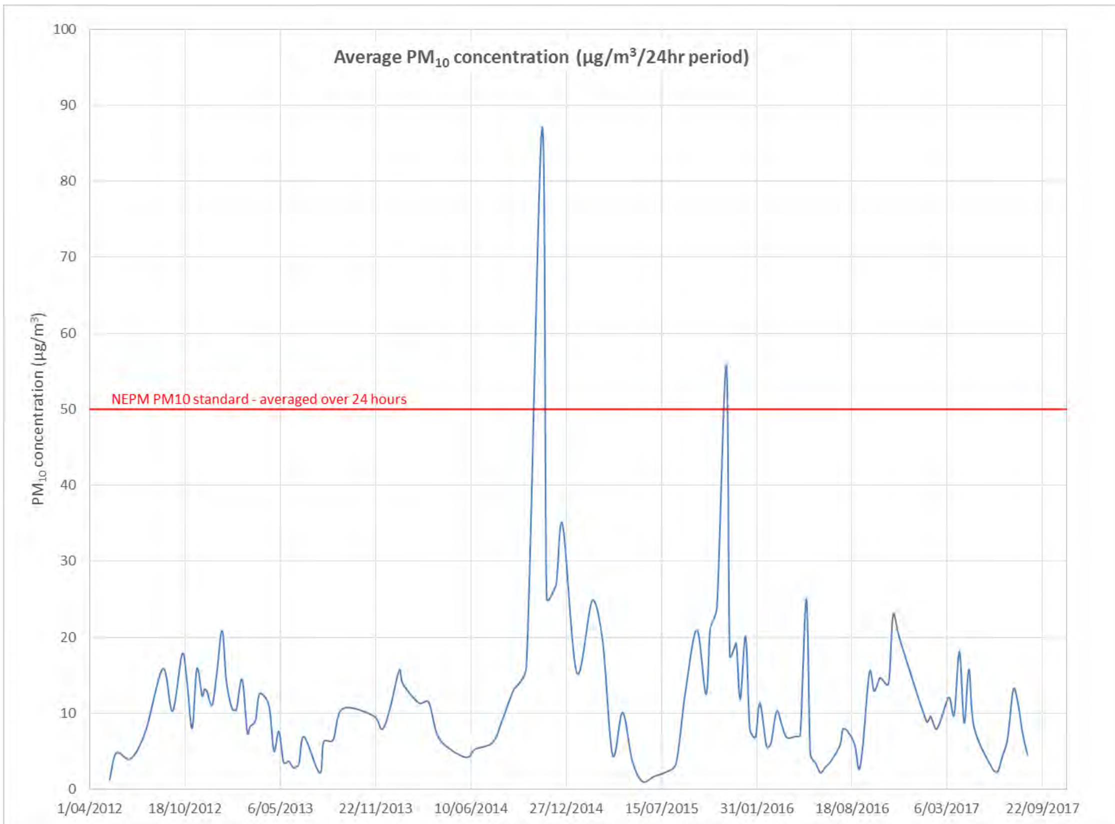

Figure 4: Measure PM10 particulate concentration at the MRUP

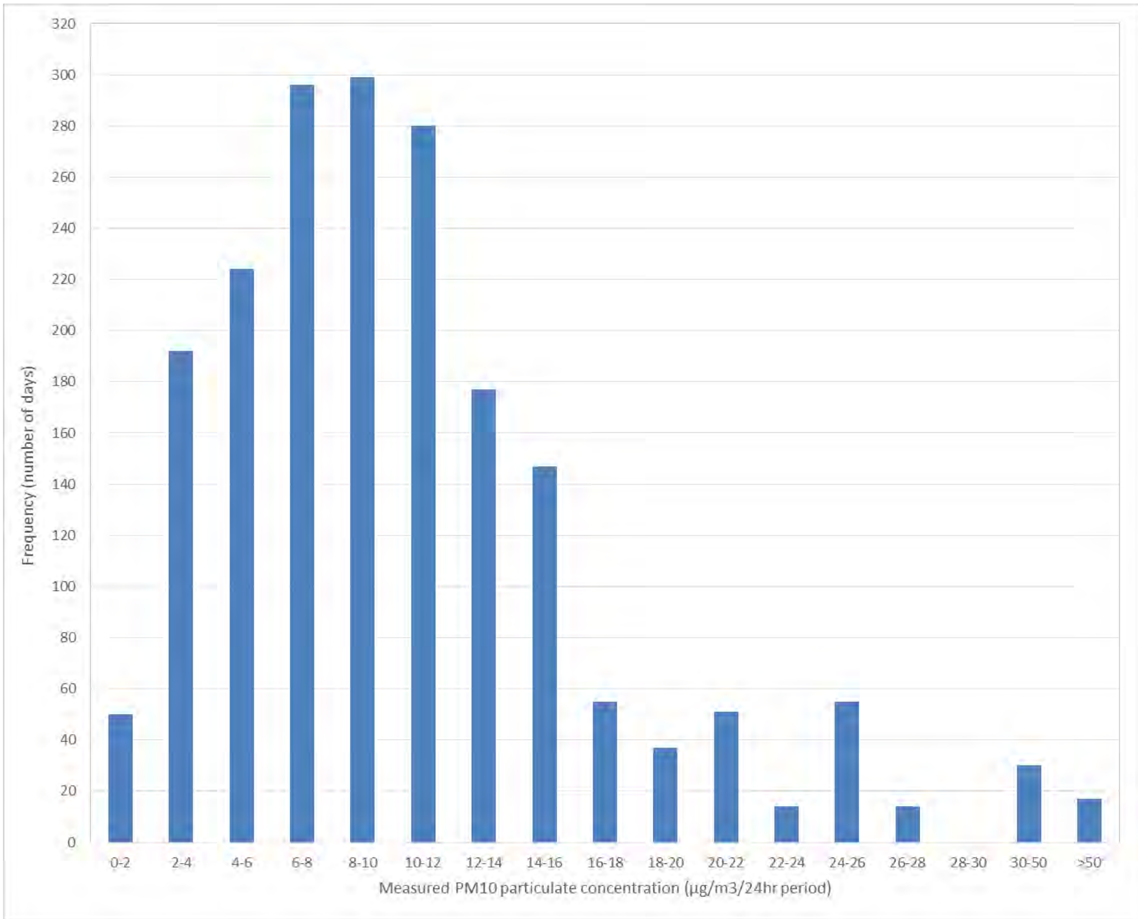

Figure 5: Frequency chart of measured PM10 particulate concentration within the MRUP

Landform Evolution Modelling (LEM)

The stability of proposed cover systems, and of the various overburden materials likely to be used to construct the cover system, were modelled using SIBERIA for time periods exceeding 1,000 years and have been laboratory tested and field validated. SIBERIA modelling has shown that the cover system remains intact over the long-term, and that actual measured erosion rates from post-mine landforms associated with the Geotechnical Investigation Trenches (GITs) varied from -12 t/ha/yr (gain) to 149 t/ha (loss), with an average of 41t/ha/yr and a median of 32t/ha/yr (Figure 6 to Figure 8). This effectively equates to 1.94mm/yr or 1.94m over 1,000 years. This is a worst-case scenario and assumes that the post-mine landform remains unvegetated over this time period, which is highly unlikely given the non-limiting physical and chemical properties of the various overburden materials.

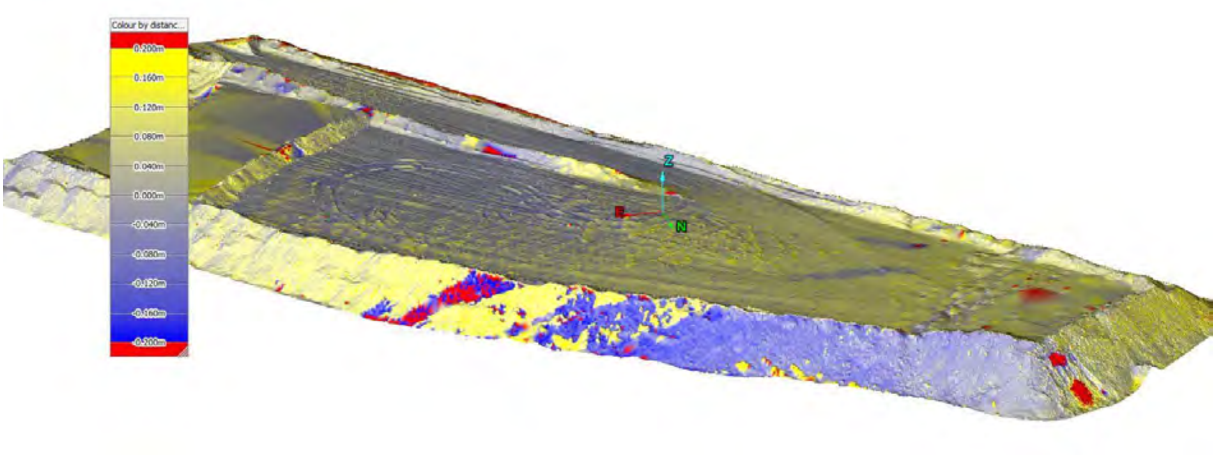

Figure 6: Annual change in land surface for the calcrete OL at the West GIT

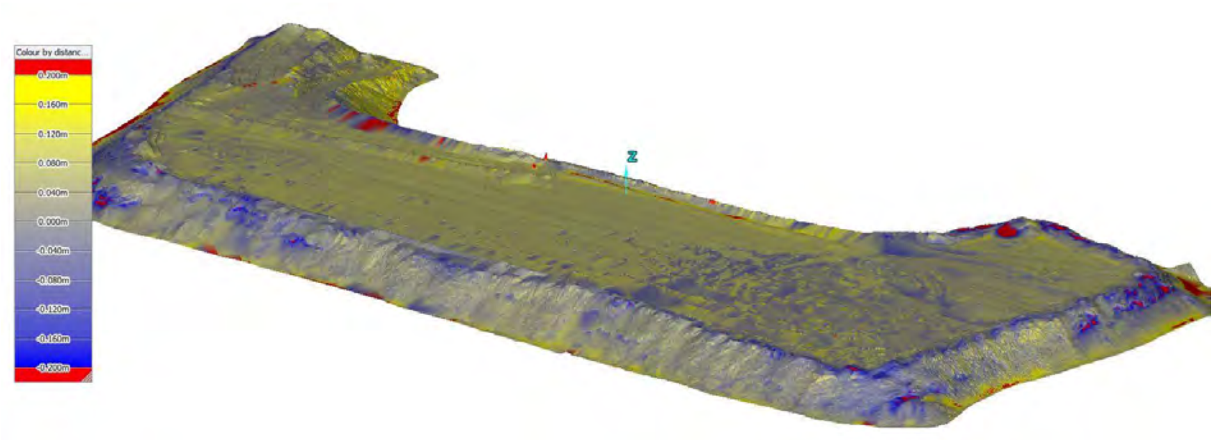

Figure 7: Annual change in land surface for the Quaternary Sand OL at the West GIT

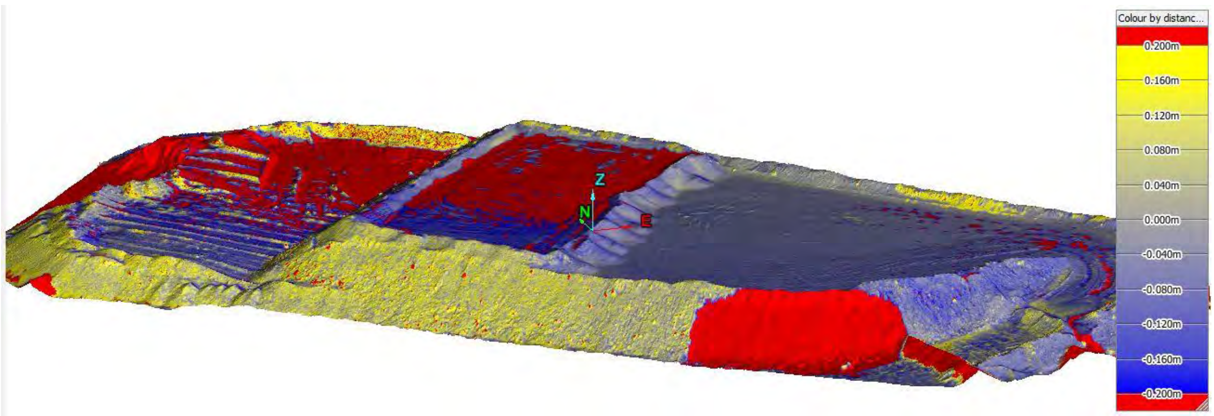

Figure 8: Annual change in land surface for the Calcrete OL at the East GIT

1.4.2 Key assumptions and uncertainties

It is assumed that the baseline data collected for the MRUP, and which has been used to assess the risks associated with the Project, have sufficiently captured and characterised the heterogeneity of materials to be disturbed and their handling and utilisation risks. However, given the large spatial extent of the MRUP, it is possible that some materials and processes may not have been identified and quantified sufficiently to accurately assess risk. It is important to note that the characterisation of materials and understanding of processes will continue throughout the LOM of the Project and thus the risks will be continually updated and reviewed, and management actions and targets implemented, where necessary, to reduce these risks as far as practicable.

1.4.3 Management approach

The management approach to be applied is based on sound scientific and technical understanding of the radiation risks to members of the public and non-human biota, and of the processes that may adversely impact the Terrestrial Environmental Quality of the region. Developed management targets and actions have therefore been developed on these principles to ensure that they are realistic, attainable and effectively reduce the risks.

In addition, the management approach will rely on:

- Environmental Inductions – to ensure that all new personnel entering the MRUP are aware of the environmental qualities within the MRUP and how their actions may impact on these qualities.
- Environmental Training – this will ensure that all personnel undertaking works on the proposed above-ground TSF are properly trained, are competent to perform the task, and that fit-for-purpose equipment is used to minimise the future risks to members of the public, non-human biota and the Terrestrial Environmental Quality of the region.
- Contributing Factors – identification and implementation of management actions to minimise and prevent the contributing factors that may increase the risks to members of the public and non-human biota and may lead to adverse impacts on the surrounding environmental qualities.

If monitoring shows that the above-ground TSF represents an existing or developing safety and stability issue, then investigations will be undertaken to determine the contributing factors and re-evaluate the appropriateness of existing management actions, establishing new management actions if required, to achieve the management targets and overall environmental objectives.

1.4.4 Rationale for choice of provisions

A performance indicator has been established for each contributing factor listed in Section 1.2 that may cause influence the safety and stability of the above-ground TSF. It is expected that by implementing the identified management actions, then the management targets will be achieved which will ensure that the environmental objectives are met.

Further protection of Terrestrial Environmental Quality and Inland Waters Environmental Quality will be achieved by Condition 15-1 which requires that:

1. Tailings plume from the TSFs (both above and in-pit) remains within background groundwater concentration at the M39/1080 (now M39/1104) lease boundary;

2. A 2m thick carbonaceous layer occurs below the in-pit TSFs to reduce acidic and potentially metal-laden tailings seepage impacting on groundwater quality; and

3. A 1m thick clay liner occurs beneath the above-ground TSF to reduce acidic and potentially metal-laden tailings seepage impacting on surrounding soils and groundwater quality.

2. Condition EMP Provisions

This section of the EMP identifies the legal provisions that Vimy proposes to implement to minimise direct and indirect impacts as far as practicable on all conservation significant flora species; and minimise direct and indirect impacts as far as practicable on the vegetation communities E3 and S6. It identifies the management actions that Vimy will implement and how they will be monitored and reported, to achieve the management target; thus, ensuring that the environmental objectives of Condition 16-1 are met. Table 1 provides a detailed list of these provisions.

This section also identifies how Vimy will review and revise management actions if the management targets are exceeded.

2.1 Outcome

As specified in Ministerial Statement No. 1046 the environmental outcome for Condition 16 is:

- Condition 16-1(1): ensure that the above ground Tailings Storage Facility is safe to members of the public and non-human biota, geo-technically and geomorphologically stable, and geo chemically non-polluting.

2.2 Performance indicators (environmental criteria)

The following performance indicators (Trigger and Threshold criteria) have been identified to ensure that the above environmental outcome is achieved:

<u>Safety</u>

Trigger Criterion 1:	Annual (average over 5 years) total dose after rehabilitation ≥ 0.3 mSv/yr above natural background level.
Threshold Criterion 1:	Annual (average over 5 years) total dose after rehabilitation ≥1 mSv/yr above natural background level.
Trigger Criterion 2:	Depositional dust from the rehabilitated TSF ≥ 2.0 g/m^2/month above background (annual average).
Threshold Criterion 2:	Depositional dust from the rehabilitated TSF ≥ 4.0 g/m^2/month above background (annual average).

The safety of the above-ground TSF to members of the public and non-human biota is further afforded by the requirement that the Certificate of Compliance (Construction), TSF Audit Reports (Operation) and TSF Decommissioning and Closure Reports (Rehabilitation and Closure) must be approved by DMIRS emphasising that the TSF was built to design, operated in accordance with prescribed conditions and was decommissioned, rehabilitated and closed in accordance with best practice.

<u>Stability (geotechnical and geomorphological)</u>

Trigger Criterion 3:	Gulley formation has created a gulley ≥ 50cm.
Threshold Criterion 3:	Gulley formation has created a gulley ≥ 100cm.
Trigger Criterion 4:	Biennial revision of Landform Evolution Modelling (LEM).
Threshold Criterion 4:	Triennial revision of Landform Evolution Modelling (LEM).
Trigger Criterion 5:	Revegetation growth not apparent - 2 years after rehabilitation earthworks completed.
Threshold Criterion 5:	Revegetation growth not appearing to meet rehabilitation criteria - 4 years after rehabilitation earthworks completed.

Trigger Criterion 6:	Rehabilitation does not achieve > 50% of the completion criteria specified in the approved Mine Closure Plan (MCP) for species richness, plant density and foliage cover within 5 years after revegetation works completed
Threshold Criterion 6:	Rehabilitation does not achieve > 30% of the completion criteria specified in the approved Mine Closure Plan (MCP) for species richness, plant density and foliage cover within 5 years after revegetation works completed

Geochemically stability (non-polluting)

Release of polluting material will be controlled by both the underdrainage system and by the leak detection system – both of which enable liquid from the base of the TSF (underdrainage) and beneath the base (leak detection system) to be recirculated. In the event that both of these systems fail and seepage is able to enter the groundwater beneath the Above Ground TSF, if it is not neutralised by the underlying calcrete (and the contained metals trapped) its presence will be measurable as a variation in background groundwater level quality located downstream from the Above Ground TSF.

Trigger Criterion 7:	Groundwater quality (as measured by pH, TDS and key metal ion concentrations {Zn, Ni, CU, Co, U – in mg/L}) ≥ 1.65 standard deviations different from background groundwater concentrations at the location of the 'Above Ground TSF Monitoring Bores' for three or more consecutive monitoring periods (a monitoring period is three months). Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.
Threshold Criterion 7:	Groundwater quality (as measured by pH, TDS and key metal ion concentrations {Zn, Ni, CU, Co, U – in mg/L}) ≥ 2 standard deviations different from background groundwater concentrations at the location of the 'Above Ground TSF Monitoring Bores' for three or more consecutive monitoring periods (a monitoring period is three months). Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.

2.3 Response actions

The following specific response actions will be implemented to achieve the above performance indicators.

Safety

Trigger Criterion 1:

Trigger level actions

- Investigate potential sources and contributing factors for Trigger Criterion exceedance, including undertaking repeat measurements of both gamma and radon to establish more clearly cause and location of radiation containment failure.
- Undertake risk assessment to determine potential environmental impact or harm to members of the public caused by elevated dose rates.
- Implement mitigation measures to improve tailings emissions containment by repairing any reduction in cover material or adding additional layers to increase radon attenuation and gamma shielding properties of the cover material. Such measures to include identifying any polluted material and recovering and disposing of appropriately.
- Continue monitoring to confirm efficacy of mitigation measures.
- Identify and implement additional measures to prevent the Trigger Criterion being exceeded in the future.

Threshold Criterion 1:

Threshold contingency actions

- Investigate potential sources and contributing factors for Threshold Criterion exceedance including undertaking repeat measurements of both gamma and radon to establish more clearly cause and location.
- Establish spatial extent of Threshold Criterion exceedance by undertaking further measurements in the area separate from the original locations where exceedances observed.
- Undertake risk assessment to determine potential environmental impact or harm to members of the public caused by elevated dose rates.
- Implement mitigation measures to improve tailings emissions containment by repairing any reduction in cover material or adding additional layers to increase radon attenuation and gamma shielding properties of the cover material. Such measures to include identifying any polluted material and recovering and disposing of appropriately.
- Continue monitoring to confirm efficacy of mitigation measures.
- Identify and implement additional measures to prevent the Threshold Criterion being exceeded in the future.

Trigger Criterion 2:

Trigger level actions

- Investigate potential sources and contributing factors leading to excessive dust deposition emanating from Above Ground TSF by measuring and establishing spatial extent of dust deposition
- Undertake risk assessment to determine potential environmental impact or harm to members of the public caused by excessive dust deposition.
- Implement mitigation measures such as increasing vegetative cover to reduce erosion and bring dust deposition rates from the TSF back below Trigger Criterion 2.
- Continue monitoring to confirm efficacy of mitigation measures.
- Identify additional measures to prevent the Trigger Criterion 2 being exceeded in the future.

Threshold Criterion 2:

Threshold contingency actions

- Investigate potential sources and contributing factors leading to excessive dust deposition emanating from Above Ground TSF by measuring and establishing spatial extent of dust deposition
- Undertake risk assessment to determine potential environmental impact or harm to members of the public caused by excessive dust deposition.
- Implement mitigation measures such as increasing vegetative cover to reduce erosion and bring dust deposition rates from the TSF back below Trigger Criterion 2.
- Continue monitoring to confirm efficacy of mitigation measures.
- Identify additional measures to prevent the Threshold Criterion 2 being exceeded in the future.

Stability (geotechnical and geomorphological)

Trigger Criterion 3:

Trigger level actions

- Investigate the potential causes of the gulley formation.
- Undertake risk assessment to determine whether gulley formation is likely to progress further and whether this would represents a threat to the integrity of the cover material.
- Implement mitigation measures to rectify, control, prevent or abate gulley formation, including filling in gullies, re-profiling the Above Ground TSF cover material to redirect water flow and improving vegetative cover to stabilise the cover material.
- Continue monitoring to confirm efficacy of mitigation measures.
- Identify additional measures to prevent the Trigger Criterion 3 being exceeded in the future.

Threshold Criterion 3:

Threshold contingency actions

- Investigate the potential causes of the gulley formation.
- Undertake risk assessment to determine whether gulley formation is likely to progress further and whether this would represents a threat to the integrity of the cover material.
- Implement mitigation measures to rectify, control, prevent or abate gulley formation, including filling in gullies, re-profiling the Above Ground TSF cover material to redirect water flow and improving vegetative cover to stabilise the cover material.
- Continue monitoring to confirm efficacy of mitigation measures.
- Identify additional measures to prevent the Threshold Criterion 3 being exceeded in the future.

Trigger Criterion 4:

Trigger level actions

- Investigate the reasons why the annual survey of the Above Ground TSF and its comparison to LEM has failed to occur for two years.
- Implement measures to ensure that an Above Ground TSF survey using LiDAR and its comparison with LEM will be undertaken within the next year.

Threshold Criterion 4:

Threshold contingency actions

- Immediately undertake a survey of the Above Ground TSF and compare the data to the LEM to ensure that the landform is behaving as modelled.

Trigger Criterion 5:

Trigger level actions

- Investigate the reasons why vegetation growth within the applied suitable growth medium has not commenced.
- If investigation suggests that there has been a wholesale failure of the contained seeds and other potential germinating material to commence growth, establish whether the apparent cause is due to the condition within the growth medium, or a failure of the germinating plant material itself.
    - If growth medium conditions are unsuitable determine whether rectification measures are possible and apply if appropriate
    - If germinating plant material is likely cause of failure establish whether further time is required or whether new plant material needs to be added.
- Implement any identified required measures.

Threshold Criterion 5:

Threshold contingency actions

- Investigate the reasons why vegetation growth within the applied suitable growth medium does not appear to be developing in a manner likely to achieved agreed rehabilitation criteria in a suitable timeframe.
- If investigation suggests that there has been a failure of sufficient of the contained seeds and other potential germinating material to commence growth, establish whether the apparent cause is due to the conditions within the growth medium, or a failure of the germinating plant material itself.
    - If growth medium conditions are unsuitable determine whether rectification measures are possible and apply if appropriate
    - If germinating plant material is likely cause of failure of sufficient germination and growth whether further time is required or whether new plant material needs to be added.
- Implement any identified required measures.

Trigger Criterion 6:

Trigger level actions

- Investigate potential sources and contributing factors for failure to achieve 50% of completion criteria within 5 years after initial rehabilitation completed.
- Having established likely cause of failure implement measures to rectify as appropriate including making adjustments to the growth medium and applying new plant growth material as necessary to ensure compliance with completion criteria within a reasonable timeframe.

Threshold Criterion 6:

Threshold contingency actions

- Investigate potential sources and contributing factors for failure to achieve 30% of completion criteria within 5 years after initial rehabilitation completed.
- Having established likely cause of failure implement measures to rectify as appropriate including making adjustments to the growth medium and applying new plant growth material as necessary to ensure compliance with completion criteria within a reasonable timeframe.

Trigger Criterion 7:

- Investigate potential sources and contributing factors for the Trigger Criteria exceedance – initially this would involve extended pumping from the Above Ground TSF Monitoring Bores to check whether the levels being recorded are consistent and indicate that the reduction in groundwater quality is being caused by seepage from the Above Ground TSF.
- Implement mitigation measures to prevent further seepage from Above Ground TSF and recover polluted material that has already seeped.
    - Use installed underdrainage system and installed leak detection system in Above Ground TSF to pump out any remaining liquor and transfer to and dispose of within suitable in-pit TSF.
    - Use Above Ground TSF Monitoring bores to intercept plume and transfer to in-pit TSF for suitable disposal if necessary.

Threshold Criterion 7:	• Investigate potential sources and contributing factors for the Threshold Criteria exceedance – initially this would involve extended pumping from the Above Ground TSF Monitoring Bores to check whether the levels being recorded are consistent and indicate that the reduction in groundwater quality is being caused by seepage from the Above Ground TSF. • Implement mitigation measures to prevent further seepage from Above Ground TSF and recover polluted material that has already seeped. o Use installed underdrainage system and installed leak detection system in Above Ground TSF to pump out any remaining liquor and transfer to and dispose of within suitable in-pit TSF. o Use Above Ground TSF Monitoring bores to intercept plume and transfer to in-pit TSF for suitable disposal if necessary.

2.4 Monitoring

For each performance indicator (environmental criteria) listed in Section 2.2, a specific monitoring program or task will be undertaken to measure performance against the environmental outcome and whether the trigger level actions or threshold contingency actions listed in Section 2.3 need to be implemented. If monitoring identifies that the performance indicators have not been met, then there is a risk that the environmental outcome will also not be achieved.

The specific monitoring tasks to be undertaken for each performance indicator is outlined below.

Performance Indicator	Monitoring
Safety	
Trigger 1 / Threshold 1	Passive gamma & radon monitors will be placed on the TSF (four in total) and at monitoring sites located 100m from the TSF in the four cardinal directions aligned to the dominant wind direction. The TLDs and PRMs will be run continuously for a period of at least five years after rehabilitation and tested quarterly to calculate dose rates adjacent the TSF. The monitoring and testing will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan and there is no risk that the containment and shielding provided by the cover will become inadequate.
Trigger 2 / Threshold 2	Dust depositional gauges (DDGs) located at the same four sites surrounding the TSF as the TLD and PRMs (i.e. 100m from the TSF). DDGs will be continuously run, with samples collected quarterly, for a period of at least five years, with no trigger or threshold criteria exceedances, after rehabilitation of the TSF. The monitoring and testing will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan and there is no risk of excessive erosion developing. ERICA assessment

Performance Indicator	Monitoring
Trigger 3 / Threshold 3	Annual high-resolution scanning of the land surface (LiDAR) for a period of at least five years after rehabilitation with no trigger or threshold criteria exceedance. Scanning and evaluation will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan and there is no risk of excessive gullies developing leading to loss of containment.
Trigger 4 / Threshold 4	Annual audit of updated LEM and comparison with actual DEM data to determine validity of the model predictions. Continue monitoring of LEM against actual DEM data for a period of at least six years after rehabilitation to establish the validity of the model and confirm that the trigger and threshold criteria are met. The scanning and evaluation will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan and there is no risk of excessive erosion developing leading to loss of containment.
Trigger 5 / Threshold 5	Annual audit of GDAP system which includes the dates, areas and rehabilitation works completed over all disturbance areas. Annual audit of rehabilitation land surfaces using the GDAP system will be continued for a period of at least five years, to ensure no trigger or threshold exceedances. The monitoring and evaluation will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan.
Trigger 6 / Threshold 6	Annual audit of rehabilitation monitoring results. Rehabilitation performance will be monitored for a period of at least five years, with no trigger or threshold exceedance. The monitoring and evaluation will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan.
Trigger 7 / Threshold 7	Monitoring will initially be undertaken at the Above Ground TSF Monitoring Bores on a six-monthly basis for the first two years whilst baseline data is being compiled. Once baseline data has been established monitoring will be undertaken on a continuous basis at the Above Ground TSF Monitoring Bores for pH and salinity. The average value over a three-month period (the monitoring period) will be calculated each quarter and logged. In the event that Trigger Criterion 7 is exceeded the groundwater will be pumped and sampled for an extended period sufficient to establish whether or not the exceedance represents an isolated event or evidence of ongoing seepage form Above Ground TSF. Annual audit of groundwater monitoring data from the Above Ground TSF Monitoring Bores. Monitoring will also take place as part of Groundwater MMP at bores located in proximity to mining areas.

As specified in Condition 6-4, if the above monitoring indicates exceedance of trigger criteria and / or threshold criteria, then:

(1) report the exceedance to the CEO in writing within seven (7) days of the exceedance being identified;

(2) immediately implement the trigger level actions and / or threshold contingency actions specified in the Condition Environmental Management Plan(s) and continue implementation of those actions until the trigger criteria and / or threshold criteria are being met and implementation of the trigger level actions and / or threshold contingency actions are no longer required;

(3) investigate to determine the cause of the trigger criteria and / or threshold criteria being exceeded;

(4) identify additional measures required to prevent the trigger and / or threshold criteria being exceeded in the future;

(5) investigate to determine potential environment harm or alteration of the environmental that occurred due to threshold criteria being exceeded; and

(6) provide a report to the CEO within ninety (90) days of the exceedance being reported. The report will include:

(a) details of trigger level actions or threshold contingency actions implemented;

(b) the effectiveness of the trigger level actions or threshold contingency actions implemented, monitored and measured against trigger criteria and threshold criteria;

(c) the findings of the investigations required by Condition 6-4(3) and 6-4(5);

(d) additional measures to prevent the trigger or threshold criteria being exceeded in the future; and

(e) measures to prevent, control or abate the environmental harm which may have occurred.

2.5 Reporting

Reporting of the above monitoring results, and achievement of the performance indicators that satisfy the environmental outcome, will occur in the Compliance Assessment Report (CAR) to be submitted annually (in March; starting in 2018) to the CEO of the EPA.

In accordance with Condition 4-6, the CAR shall:

(1) be endorsed by Vimy's CEO or other person delegated to sign on the CEO's behalf;

(2) include a statement as to whether Vimy has complied with the conditions;

(3) identify all potential non-compliances and describe corrective and preventative actions taken;

(4) be made publicly available in accordance with the approved Compliance Assessment Plan (CAP); and

(5) indicate any proposed changes to the CAP required by Condition 4-1.

The CAR will also include:

- Monitoring results and trends against performance indicators;
- Any exceedance of trigger criteria and / or threshold criteria;
- A review of the response actions and their appropriateness in achieving the performance indicators and the overall environmental outcome.
- Proposed revision of the performance indicators, and corresponding response actions, if required, to obtain formal approval from the Office of the EPA (OEPA) to amend the CEMP.

In addition to the CAR, all results from specific monitoring programs (e.g. dust monitoring, radiation monitoring) and details of any environmental discharges (e.g. saline water spills) will be presented in the Annual Environmental Report (AER). Furthermore, results of rehabilitation performance will be reported in the annual Mine Rehabilitation Fund (MRF) document.

3. Adaptive Management and Review of the Condition EMP

3.1 Review and revision of performance indicators and response actions

In the event that a performance indicator (trigger or threshold) is exceeded, or the identified response actions do not result in the performance indicator(s) being met, then Vimy will review and revise the risk assessment, review and revise performance indicator(s) and response actions, and identify additional response actions where necessary.

Risks and key impacts associated with response actions and priorities will be reviewed and revised and, if necessary, implement the following adaptive management procedure:

- Investigate the potential cause for the performance indicator exceedance and identify any impacts to public and non-human biota safety, and the stability of the above-ground TSF resulting from this exceedance.
- If the causes of the exceedance or the efficacy of the response actions are found to be deficient, then the risk assessment will be reviewed and revised risk based response actions will be implemented, following formal approval from the OEPA, so that the MRUP environmental outcome is met.

Vimy will also implement adaptive management to learn from the implementation of mitigation measures, monitoring and evaluation against performance indicators, to more effectively meet the environmental outcome. The following approach will be followed:

- Monitoring data will be systematically evaluated and compared to baseline and reference site data in a process of adaptive management to verify whether responses to the impact are the same or similar to predictions.
- Re-evaluate the risk assessment and revision of risk-based priorities on the basis of monitored information.
- Increased understanding of the local and regional ecological regime.
- Revision when response actions are not as effective as predicted.
- External changes during the life of the proposal (e.g. changes to the sensitivity of the key environmental factor, implementation of other activities in the area, etc.).
- Review of CEMP – changes to CEMP provisions required by a condition, timeframe, etc.

4. Stakeholder consultation

Extensive consultation regarding radiation risks to members of the public, and to non-human biota, and stability risks of the above-ground TSF occurred during the Public Environmental Review (PER). Specific consultation with regards to this CEMP with the DMIRS (previously DMP; Resources Safety Division) and the Radiological Council is outlined below.

Date	Decision Making Authority	Comment	Response
29/12/2016	DMP	Met with Ian Mitchell and Emily Safe to discuss MRUP and the requirements under Condition 15 and 16 regarding potential risks to the stability of the above-ground TSF.	No response needed
22/02/2017	DMP	Met with DMP Environmental Officers to discuss the Draft CEMP and its fulfilment of Ministerial Statement 1046	Vimy to ensure that this CEMP is prepared in accordance with MS 1046
09/03/2017	Radiological Council	Met with Duncan Surin and Dean Crouch to discuss the Operational Radiation Management Plan, which includes radiation safety from the above-ground TSF	No response needed
24/05/2017	DMP	Met with Ian Mitchell, Damien Montague and Emily Safe to discuss specific management of AMD and other aspects that may impact soil quality.	No response needed
13/01/2021	Radiological Council	Met with Duncan Surin and Hazel Upton. Suggested that the triggers and thresholds for the radiological aspects of the Above Ground TSF MMP should be confined to simply the effective dose as this covers both radon emanation and radionuclides in soil and having these as separate triggers and thresholds is superfluous.	Vimy agreed to simplify the MMP by removing direct radon emanation and nuclides in soil as triggers and thresholds as suggested by the Radiological Council

Table 1: CEMP Provisions (outcome-based) table

Purpose of EMP	**To meet the legal requirements of Condition 16 of Ministerial Statement 1046**
EPA Factor	**Terrestrial Environmental Quality**
EPA Objective	**To maintain the quality of land and soils so that environmental values are protected**
MS 1046 Condition 16-1 Environmental Outcome:	**(1) ensure that the above ground Tailings Storage Facility is safe to members of the public and non-human biota, geo-technically and geomorphologically stable, and geo chemically non-polluting.**

Management-based provisions

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
Safety	**Trigger Criterion 1**: Annual (average over 5 years) total dose after rehabilitation ≥ 0.3 mSv/yr above natural background level.	***Trigger level actions*** • Investigate potential sources and contributing factors for Trigger Criterion exceedance, including undertaking repeat measurements of both gamma and radon to establish more clearly cause and location of radiation containment failure. • Undertake risk assessment to determine potential environmental impact or harm to members of the public caused by elevated dose rates. • Implement mitigation measures to improve tailings emissions containment by repairing any reduction in cover material or adding additional layers to increase radon attenuation and gamma shielding properties of the cover material. Such measures to include identifying any polluted material and recovering and disposing of appropriately. • Continue monitoring to confirm efficacy of mitigation measures.	Passive gamma & radon monitors will be placed on the TSF (four in total) and at monitoring sites located 100m from the TSF in the four cardinal directions aligned to the dominant wind direction. The TLDs and PRMs will be run continuously for a period of at least five years after rehabilitation and tested quarterly to calculate dose rates adjacent the TSF. The monitoring and testing will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan and there is no risk that the containment and shielding provided by the cover will become inadequate.	CAR

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
		• Identify and implement additional measures to prevent the Trigger Criterion being exceeded in the future.		
	Threshold Criterion 1: Annual (average over 5 years) total dose after rehabilitation ≥ 1 mSv/yr above natural background level.	***Threshold contingency actions*** • Investigate potential sources and contributing factors for Threshold Criterion exceedance including undertaking repeat measurements of both gamma and radon to establish more clearly cause and location. • Establish spatial extent of Threshold Criterion exceedance by undertaking further measurements in the area separate from the original locations where exceedances observed. • Undertake risk assessment to determine potential environmental impact or harm to members of the public caused by elevated dose rates. • Implement mitigation measures to improve tailings emissions containment by repairing any reduction in cover material or adding additional layers to increase radon attenuation and gamma shielding properties of the cover material. Such measures to include identifying any polluted material and recovering and disposing of appropriately. • Continue monitoring to confirm efficacy of mitigation measures.		

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
		Identify and implement additional measures to prevent the Threshold Criterion being exceeded in the future.		
	Trigger Criterion 2: Depositional dust from the rehabilitated TSF ≥ 2.0 g/m²/month above background (annual average).	• Investigate potential sources and contributing factors leading to excessive dust deposition emanating from Above Ground TSF by measuring and establishing spatial extent of dust deposition. • Undertake risk assessment to determine potential environmental impact or harm to members of the public caused by excessive dust deposition. • Implement mitigation measures such as increasing vegetative cover to reduce erosion and bring dust deposition rates from the TSF back below Trigger Criterion 2. • Continue monitoring to confirm efficacy of mitigation measures. • Identify additional measures to prevent the Trigger Criterion 2 being exceeded in the future.	Dust depositional gauges (DDGs) located at the same four sites surrounding the TSF as the TLD and PRMs (i.e. 100m from the TSF). DDGs will be continuously run, with samples collected quarterly, for a period of at least five years, with no trigger or threshold criteria exceedances, after rehabilitation of the TSF. The monitoring and testing will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan and there is no risk of excessive erosion developing. ERICA assessment	CAR AER
	Threshold Criterion 2: Depositional dust from the rehabilitated TSF ≥ 4.0 g/m²/month above background (annual average)	***Threshold contingency actions*** • Investigate potential sources and contributing factors leading to excessive dust deposition emanating from Above Ground TSF by measuring and establishing spatial extent of dust deposition • Undertake risk assessment to determine potential environmental impact or harm to members of the public caused by excessive dust deposition.		

<table>
<tr><th>Risk / Impact</th><th>Environmental Criteria</th><th>Response Actions</th><th>Monitoring</th><th>Reporting</th></tr>
<tr><td rowspan="2"></td><td></td><td>• Implement mitigation measures such as increasing vegetative cover to reduce erosion and bring dust deposition rates from the TSF back below Trigger Criterion 2.
• Continue monitoring to confirm efficacy of mitigation measures.
• Identify additional measures to prevent the Threshold Criterion 2 being exceeded in the future.</td><td></td><td></td></tr>
<tr><td colspan="4">The safety of the above-ground TSF to members of the public and non-human biota is further afforded by the requirement that the Certificate of Compliance (Construction), TSF Audit Reports (Operation) and TSF Decommissioning and Closure Reports (Rehabilitation and Closure) must be approved by DMIRS emphasising that the TSF was built to design, operated in accordance with prescribed conditions and was decommissioned, rehabilitated and closed in accordance with best practice.</td></tr>
<tr><td>Stability (geotechnical & geomorphological)</td><td>Trigger Criterion 3: Gulley formation has created a gulley ≥ 50cm</td><td>Trigger level actions
• Investigate the potential causes of the gulley formation.
• Undertake risk assessment to determine whether gulley formation is likely to progress further and whether this would represents a threat to the integrity of the cover material.
• Implement mitigation measures to rectify, control, prevent or abate gulley formation, including filling in gullies, re-profiling the Above Ground TSF cover material to redirect water flow and improving vegetative cover to stabilise the cover material.
• Continue monitoring to confirm efficacy of mitigation measures.
• Identify additional measures to prevent the Trigger Criterion 3 being exceeded in the future.</td><td>Annual high-resolution scanning of the land surface (LiDAR) for a period of at least five years after rehabilitation with no trigger or threshold criteria exceedance. Scanning and evaluation will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan and there is no risk of excessive gullies developing leading to loss of containment.</td><td>CAR</td></tr>
</table>

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
	Threshold Criterion 3: Gulley formation has created a gulley ≥ 100cm	***Threshold contingency actions*** • Investigate the potential causes of the gulley formation. • Undertake risk assessment to determine whether gulley formation is likely to progress further and whether this would represents a threat to the integrity of the cover material. • Implement mitigation measures to rectify, control, prevent or abate gulley formation, including filling in gullies, re-profiling the Above Ground TSF cover material to redirect water flow and improving vegetative cover to stabilise the cover material. • Continue monitoring to confirm efficacy of mitigation measures. • Identify additional measures to prevent the Threshold Criterion 3 being exceeded in the future.		
	Trigger Criterion 4: Biennial revision of Landform Evolution Modelling (LEM)	***Trigger level actions*** • Investigate the reasons why the annual survey of the Above Ground TSF and its comparison to LEM has failed to occur for two years. • Implement measures to ensure that an Above Ground TSF survey using LiDAR and its comparison with LEM will be undertaken within the next year.	Annual audit of updated LEM and comparison with actual DEM data to determine validity of the model predictions. Continue monitoring of LEM against actual DEM data for a period of six years after rehabilitation to establish the validity of the model and confirm that the trigger and threshold criteria are met. The scanning and evaluation will continue until such time as the rehabilitation has been accepted as meeting	CAR AER
	Threshold Criterion 4: Triennial revision of Landform Evolution Modelling (LEM)	***Threshold contingency actions*** • Immediately undertake a survey of the Above Ground TSF and compare the data to the LEM to		

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
		ensure that the landform is behaving as modelled.	the completion criteria in the Mine Closure Plan and there is no risk of excessive erosion developing leading to loss of containment.	

	Trigger Criterion 5: Revegetation growth not apparent 2 years after rehabilitation earthworks completed.	***Trigger level actions***
		• Investigate the reasons why vegetation growth within the applied suitable growth medium has not commenced.
		• If investigation suggests that there has been a wholesale failure of the contained seeds and other potential germinating material to commence growth, establish whether the apparent cause is due to the condition within the growth medium, or a failure of the germinating plant material itself.
		    • If growth medium conditions are unsuitable determine whether rectification measures are possible and apply if appropriate
		    • If germinating plant material is likely cause of failure establish whether further time is required or whether new plant material needs to be added.
		• Implement any identified required measures.
			Annual audit of GDAP system which includes the dates, areas and rehabilitation works completed over all disturbance areas.
			
			Annual audit of rehabilitation land surfaces using the GDAP system will be continued for a period of at least five years, to ensure no trigger or threshold exceedances. The monitoring and evaluation will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan.
				CAR
				AER
				MRF

	Threshold Criterion 5: Revegetation growth not appearing to meet rehabilitation criteria 4 years after rehabilitation earthworks completed.	***Threshold contingency actions*** • Investigate the reasons why vegetation growth within the applied suitable growth medium does not appear to be developing in a manner likely to achieved agreed		

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting

		rehabilitation criteria in a suitable timeframe.
		• If investigation suggests that there has been a failure of sufficient of the contained seeds and other potential germinating material to commence growth, establish whether the apparent cause is due to the conditions within the growth medium, or a failure of the germinating plant material itself.
		  • If growth medium conditions are unsuitable determine whether rectification measures are possible and apply if appropriate
		  • If germinating plant material is likely cause of failure of sufficient germination and growth whether further time is required or whether new plant material needs to be added.
		• Implement any identified required measures.		

	Trigger Criterion 6: Rehabilitation does not achieve > 50% of the completion criteria specified in the approved MCP for species richness, plant density and foliage cover within 5 years after revegetation works completed	***Trigger level actions*** • Investigate potential sources and contributing factors for failure to achieve 50% of completion criteria within 5 years after initial rehabilitation completed. • Having established likely cause of failure implement measures to rectify as appropriate including making adjustments to the growth medium and applying new plant growth material as necessary to ensure compliance with completion	Annual audit of rehabilitation monitoring results. Rehabilitation performance will be monitored for a period of at least five years, with no trigger or threshold exceedance. The monitoring and evaluation will continue until such time as the rehabilitation has been accepted as meeting the completion criteria in the Mine Closure Plan.	CAR AER MRF

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
		criteria within a reasonable timeframe.		
	Threshold Criterion 6: Rehabilitation does not achieve > 30% of the completion criteria specified in the approved MCP for species richness, plant density and foliage cover within 5 years after revegetation works completed	***Threshold contingency actions*** • Investigate potential sources and contributing factors for failure to achieve 30% of completion criteria within 5 years after initial rehabilitation completed. • Having established likely cause of failure implement measures to rectify as appropriate including making adjustments to the growth medium and applying new plant growth material as necessary to ensure compliance with completion criteria within a reasonable timeframe. • Identify additional measures to prevent the trigger criterion being exceeded in the future.		
Geochemically stability (non-polluting)	**Trigger Criterion 7**: Groundwater quality (as measured by pH, TDS and key metal ion concentrations {Zn, Ni, CU, Co, U – in mg/L}) ≥ 1.65 standard deviations different from background groundwater concentrations at the location of the 'Above Ground TSF Monitoring Bores' for three or more consecutive monitoring periods (a monitoring period is three months). Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution.	• Investigate potential sources and contributing factors for the Trigger Criteria exceedance – initially this would involve extended pumping from the Above Ground TSF Monitoring Bores to check whether the levels being recorded are consistent and indicate that the reduction in groundwater quality is being caused by seepage from the Above Ground TSF. • Implement mitigation measures to prevent further seepage from Above Ground TSF and recover polluted material that has already seeped.	Monitoring will initially be undertaken at the Above Ground TSF Monitoring Bores on a six-monthly basis for the first two years whilst baseline data is being compiled. Once baseline data has been established monitoring will be undertaken on a continuous basis at the Above Ground TSF Monitoring Bores for pH and salinity and contained metal ions. The average value over a three-month period (the monitoring	CAR AER

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
		o Use installed underdrainage system and installed leak detection system in Above Ground TSF to pump out any remaining liquor and transfer to and dispose of within suitable in-pit TSF. o Use Above Ground TSF Monitoring bores to intercept plume and transfer to in-pit TSF for suitable disposal if necessary.	period) will be calculated each quarter and logged. In the event that Trigger Criterion 7 is exceeded the groundwater will be pumped and sampled for an extended period sufficient to establish whether or not the exceedance represents an isolated event or evidence of ongoing seepage form Above Ground TSF. Annual audit of groundwater monitoring data from the Above Ground TSF Monitoring Bores. Monitoring will also take place as part of Groundwater MMP at bores located in proximity to mining areas.	
	Threshold Criterion 7: Groundwater quality (as measured by pH, TDS and key metal ion concentrations {Zn, Ni, CU, Co, U – in mg/L}) ≥ 2 standard deviations different from background groundwater concentrations at the location of the 'Above Ground TSF Monitoring Bores' for three or more consecutive monitoring periods (a monitoring period is three months). Data will be adjusted for skew and kurtosis or whatever transformation is required to create a standard normal distribution	• Investigate potential sources and contributing factors for the Threshold Criteria exceedance – initially this would involve extended pumping from the Above Ground TSF Monitoring Bores to check whether the levels being recorded are consistent and indicate that the reduction in groundwater quality is being caused by seepage from the Above Ground TSF. • Implement mitigation measures to prevent further seepage from Above Ground TSF and recover polluted material that has already seeped.		

Risk / Impact	Environmental Criteria	Response Actions	Monitoring	Reporting
		o Use installed underdrainage system and installed leak detection system in Above Ground TSF to pump out any remaining liquor and transfer to and dispose of within suitable in-pit TSF. o Use Above Ground TSF Monitoring bores to intercept plume and transfer to in-pit TSF for suitable disposal if necessary.		
	Release of polluting material will be controlled by both the underdrainage system and by the leak detection system – both of which enable liquid from the base of the TSF (underdrainage) and beneath the base (leak detection system) to be recirculated. In the event that both of these systems fail and seepage is able to enter the groundwater beneath the Above Ground TSF, if it is not neutralised by the underlying calcrete (and the contained metals trapped by the calcrete) its presence will be measurable as a variation in background groundwater level quality located downstream from the Above Ground TSF.			

5. References

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