

6.0 Validation Program

The RAP presented the plan for the validation of the Site, which was stated to be required to be collected to verify the effectiveness of the remediation works and to document the condition of the Site at the conclusion of the remediation works. The RAP stated that prior to validation works being undertaken at the Site, a detailed Sampling Plan would be prepared to document the data quality objectives (DQOs), sampling program, sampling methods, analytical suites and other field procedures.

The validation plan presented in the RAP included detail on the proposed sampling and analytical plan, sampling methodology and quality control and quality assurance procedures to be included in the Sampling Plan to be developed and adopted for the validation works. These matters are discussed below.

Auditor's opinion

The Auditor notes that the validation plan presented in the RAP did not include the DQOs, which are required to be developed in accordance with the seven-step iterative process (NSW DEC, 2006) to determine the requirements for an appropriate sampling and analytical plan for the validation of the Site after the completion of the remediation works and to determine how to assess the reliability of the results of the validation program to ensure they are appropriate to meet the overall objective of the works to ensure that the Site is suitable for the proposed land use. However, given that the validation plan presented in the RAP included the requirement for the development of a Sampling Plan prior to the commencement of validation works on the Site and that this Sampling Plan would present DQOs in accordance with NSW DEC (2006), the Auditor considers that this approach to the development of DQOs for the validation works is acceptable and satisfies the requirements of the previous SAR.

The Auditor requires that prior to validation works being undertaken, the Sampling Plans be prepared in the form of a validation sampling, analytical and quality plan (SAQP) in accordance with the guidelines endorsed by NSW DECC and be issued to the Auditor for endorsement.

6.1 Validation Criteria

The RAP stated that the validation criteria for the Site needed to define an appropriate end point to the extent of remediation that considered the protection of sensitive receptors. The RAP presented the criteria to be adopted for the validation works and the rationale for the selection of the criteria, as detailed below.

6.1.1 Soil Criteria

The RAP stated that the set of soil validation criteria for the Site were developed with respect to the remedial approach, the remediation goals for the Site and the future use of the Site for commercial/industrial rail-related activities. It was stated that the criteria would be adopted accordance with the potential exposure pathways and sensitive receptors as follows:

- It was stated that exposure risks to site users from soil at depths of between surface level and 1.5 m bgs would be dermal contact and incidental soil ingestion. The RAP stated that "Generic conservative criteria protective of human receptors to dermal and ingestion exposure risks associated with impacted soils" would be adopted for the validation of soils present at the surface to a depth of 1.5 m bgs as follows:

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- Concentrations of PAHs and Metals - Health-based Investigation Level (HIL) Column 4 for commercial/industrial land use, as stated in NSW DEC (2006).
 - Concentrations of BTEX – Ecological health based criteria as stated in NSW EPA (1994).
 - Asbestos – It was stated that as there were no national or NSW DECC endorsed guidelines relating to the presence of asbestos in soils, the guidance provided in the Australian Contaminated Land Consultants Association (ACLCA) Asbestos in Soils – Code of Practice 2002 of "no detection of fibres in surface soil and no visible fragments in the surface soil" would be adopted.
- At depths of greater than 1.5 m bgs, it was stated that the potential exposure pathway to site users would be inhalation of vapours. The RAP stated that "Site-specific risk-based depth criteria that are protective of human receptors to potential inhalation exposure risks associated with impacted soils" would be adopted for the validation of soils present below 1.5 m bgs to a depth of 8.0 m bgs. The RAP further stated that no specific risk-based criteria would be adopted to validate soils at depth on the basis of protecting groundwater. It was stated that the risk-based criteria were developed using the Johnson and Ettinger (1991) one-dimensional analytical model to determine theoretical values that would apply to soil at depths of 2.5, 4.0 and 8.0 m bgs based on their potential to generate concentrations of contaminants in vapours that would pose a risk to future users of the Site.

It was further stated that no specific risk-based criteria were developed for soils present at depths greater than 8 m bgs due to the following factors;

- The risk associated with the generation of vapours from residual sources below 8.0 m bgs was stated to be low given that:
 - the vertical migration would be "restricted to the pore spaces of compacted backfill materials that would limit migration to the ground surface";
 - the spatial distance between the residual source and the surface was "considerable"; and
 - the "perched groundwater would intercept vertically migrating vapours effectively trapping vapours below the perched groundwater"
- Residual source material at or below 8 m bgs would be managed by the implementation of a long-term EMP that would include a limitation on the construction of basements on the Site.

The technical calculations and supporting data for the generation of the risk-based criteria were provided in Appendix B of the RAP and are included as Attachment 3 to this SAR.

The adopted soil validation criteria, as presented in Table 4-1 of the RAP, are summarised in Table 7 below.

Table 7: Summary of soil validation criteria

Analyte	Depth (m bgs)			
	0 – 1.5	1.5 – 2.5	2.5 – 4.0	4.0 – 8.0
Metals	Validation criteria (mg/kg)			
Arsenic	500 ¹	-	-	-
Cadmium	100 ¹	-	-	-
Chromium	500 ¹	-	-	-
Copper	5000 ¹	-	-	-
Mercury (inorganic)	75 ¹	-	-	-
Nickel	3000 ¹	-	-	-
Lead	1500 ¹	-	-	-
Zinc	35000 ¹	-	-	-
BTEX				
Benzene	1 ²	1 ⁴	1 ⁴	1 ⁴
Toluene	1.4 ²	2.6 ⁵	4.0 ⁵	7.9 ⁵
Ethylbenzene	3.1 ²	11.1 ⁵	17.6 ⁵	34.8 ⁵
Total xylenes	14 ²	14 ⁴	14 ⁴	14 ⁴
Polycyclic Aromatic Hydrocarbons				
PAH – total	100 ¹	-	-	-
Benzo(a)pyrene	5 ¹	-	-	-
Naphthalene	-	3.8 ⁵	6.0 ⁵	11.8 ⁵
Phenolic compounds				
Phenol	42500 ¹	-	-	-
Cyanide (complex)	2500 ¹	-	-	-
Asbestos	No detection to 0.5 m bgs of fibres/no visible fragments ³	-	-	-

¹ HILs for industrial / commercial land use – Column 4 of NSW DEC (2006)

² Ecological health based criteria - NSW EPA (1994)

³ ACLCA Asbestos in Soils – Practice Note 2002

⁴ Risk based criteria using Johnson and Ettinger model were lower than laboratory reporting limits (LOR) and HILs for commercial/industrial land use, therefore the RAP adopted the less conservative HILs for application at all depths.

⁵ Risk based criteria using Johnson and Ettinger (1991) one-dimensional model.

- No criteria adopted

Auditor's opinion

The Auditor considers that the proposed soil validation criteria are generally appropriate for the validation of the Site.

The Auditor agrees with the assumption that the potential exposure pathways for humans through dermal contact and ingestion are unlikely to be formed between future users of the Site and contamination present at depths of greater than 1.5 m bgs and that the inhalation of vapours is likely to be the primary exposure pathway below this depth.

The Auditor also concurs with the qualitative assessment that risks to Site users from contamination at depths of greater than 8 m bgs are likely to be low. However, the Auditor notes that the RAP does not provide a clear rationale for the adoption of 8 m bgs as the vertical limit for soil validation. The Auditor notes that the previous investigations conducted by CH2MHILL (2007) indicated that the vertical extent of contamination identified within the footprint of the former gasworks was limited to between 8 to 10 m bgs beneath the Northern Gasholder and at approximately 7 m bgs beneath the tar wells. The Auditor also notes that given the space constraints present on the Site that it is likely that 8 m bgs would be the practical limit to excavations works in these areas. Consequently, the Auditor considers that the adoption of the criteria presented in the RAP up to 8 m depth is likely to remove to the source of contamination to the extent practicable and that there is no requirement for adopting risk-based soil validation criteria at greater depths. Notwithstanding the above, the Auditor requires that the Sampling Plans to be developed for the validation works provide a detailed rationale justifying the adoption of 8 m depth as the vertical limit for soil remediation/validation.

The Auditor notes that the risk-based criteria were established using the Johnson and Ettigner (1991) model. It was noted that the model inputs required a "depth of risk based interval" to be entered into the model order to calculate the risk based criteria for each COPC. It was stated that the depths entered into the model as "depth below grade to top of contamination" were nominated as "2.5 m, 4.0 m and 8.0 m below the ground surface".

However, the Auditor notes that Table 4.1 of the RAP (see Table 7 above) presented the risk-based validation criteria outputted from the model as applying to intervals using the depth to the base of each interval rather than using the depth to the top of each interval as presented in the calculations generated from the model presented in Appendix B. For example, where the model has been run using a depth of 2.5 m bgs, the resulting model outputs (validation criteria) reported in Appendix B of the RAP as applying to materials present at 2.5 m bgs have been stated in Table 4.1 to apply to soil present between 1.5 to 2.5 m bgs. Similarly, model runs for 4 m bgs and 8 m bgs have been stated to apply to soil intervals of 2.5 to 4 m bgs and 4 to 8 m bgs respectively, instead of applying to soil at depth intervals starting from 4 m bgs and 8 m bgs, respectively. Consequently, the Auditor requires that the risk-based criteria presented in the RAP be amended to correctly reflect the outputs of the model for inclusion in the Sampling Plans to be developed for the validation works.

In addition, the Auditor noted that the Johnson and Ettigner model assumed a backfill soil type of sandy clay. The Auditor considers that provision should be made to adjust the risk based criteria and validate the excavations accordingly if a different type of backfill, such as crushed sandstone, is to be used at the Site, as the differing soil properties may affect the ability of contaminants to volatilise and migrate through the soil profile to the surface. This provision should be including in the Sampling Plans to be developed for the validation works.

The Auditor notes that the RAP stated that the use of the Phytotoxicity Investigation Levels (PILs) provided in NSW DEC (2006) were not required for the validation of the Site given its future commercial/industrial use. The Auditor agrees with this approach, however, consideration should be given to the use of PILs during the landscaping works that are proposed in the RAP as part of the reinstatement of the Site post-remediation. In these circumstances, the use of certified clean topsoil is generally adequate.

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The Auditor notes that soil validation criteria were provided only for soil to depths of 8 m bgs. However, it was stated in the RAP that when validating excavations, validation samples would be collected from excavation walls "every 2 m below 8 m bgs" (see Section 6.2.1 of this SAR). The Auditor requires that clarification of the proposed depth of excavations and sampling strategies be provided in the Sampling Plans for the validation works. If excavations are to be extended to below 8 m bgs, the Auditor requires that clarification is provided on validation criteria to be adopted for soils below 8 m bgs.

To address the uncertainties identified above, the Auditor requires that the Sampling Plans be submitted to the Auditor for endorsement prior to commencing the remediation works.

6.1.2 Beneficial Re-use Criteria

The RAP stated that excavated materials that would be considered to be suitable for beneficial re-use on-site would be required to meet the following criteria:

- Have originated and remained on the Site i.e. not been taken off-site for treatment;
- Show no visual impacts of tar;
- Total concentrations to meet the generic or risk-based criteria for soils as listed in Table 7 above;
- Natural leachate concentrations to meet criteria derived from ANZECC (2000), ANZECC (1992) and Dutch (2000) as specified in Table 9.1 of the RAP (Attachment 2); and
- Required to meet RailCorp's geotechnical requirements.

Auditor's opinion

The Auditor considers that the criteria for determining the suitability of excavated materials for beneficial re-use were appropriate for application at the Site. The Auditor requires that these criteria are included in the Sampling Plans to be developed for the validation works at the Site and that prior to the re-use of material on the Site that the suitability of that material for re-use on the Site is demonstrated to the Auditor's satisfaction.

6.1.3 Groundwater Criteria

The RAP stated that the CUTEP approach to the remediation of the source of contamination on the Site would "protect groundwater from on-going impacts" and as such it was stated that "groundwater is not considered to require remediation". The RAP stated that the monitoring and assessment of future "Potential impacts to groundwater will be addressed by implementing a program of MNA. It was stated that the evaluation of the progress of MNA would be based on a set of metrics that were stated to include the adoption of Groundwater Investigation Levels (GILs) based on the following guidance documents:

- ANZECC (2000) trigger values;
- NSW EPA (1994);
- NEPC (1999) Schedule B1;
- Netherlands Intervention Values – Water (2000); and

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- Background groundwater quality.

Further details of the MNA program are presented in Section 7 of this SAR.

Auditor's opinion

The Auditor considers that detail and justification for the selection of the criteria to be adopted for the monitoring and assessment of groundwater at the Site be included in the GMP component of the long-term EMP for the Site.

6.1.4 Assessment of Analytical Results

The RAP stated that the methodology to be used during the validation works for the comparison of soil analytical results to the validation criteria stated in Section 6.1.1 and 6.1.2 above, would be based on the methods referred to in the NSW EPA (1995) and NEPC (1999), including:

- Comparison of the 95% upper confidence limit of the arithmetic mean concentrations (95% UCL values) of each contaminant to the criteria;
- No individual sample result should have a concentrations that exceeds 250% of the adopted;
- A normal distribution will only be used if the coefficient of variance is not greater than 1.2; and
- The standard deviation of a sample population should not exceed 50% of the nominated criteria.

The RAP stated that statistical analysis would only be "performed on similar materials of the same lithology".

Auditor's opinion

The Auditor agrees that the application of statistical calculations must only be undertaken for a set of analytical results from soils within the same area of the Site and from the same soil type. The Auditor requires that if statistical calculations are applied during the validation works that both the data set used and the calculations completed are provided in full within the validation report.

6.2 Sampling Program

The RAP provided detail on the proposed frequency of sample collection for the remediation and validation works.

Auditor's opinion

The Auditor notes that the RAP did not provide information relating to the proposed sampling methodologies to be adopted for the validation works. The Auditor requires that detail on both the proposed sampling program and sampling methodologies are provided within the Sampling Plans to be developed for the validation works.

6.2.1 Excavated Areas

The RAP stated that validation sampling would be undertaken in excavated areas of the Site as follows:

- Excavation Floors - Soil samples would be collected from excavation floors on "an evenly spaced grid of 8.5m". It was stated that this sampling density rate would result in a 95% probability of detecting a circular contamination hotspot of 10 m diameter; and
- Excavation walls – Soil samples would be collected from excavation walls every 10 lineal metres and at depth intervals of 0-1.5 m bgs, 1.5-2.5 m bgs, 2.5-4.0 m bgs, 4-8 m bgs and every 2 m below 8.0 m bgs. It was further stated that "consideration should be given to materials types to ensure that samples representative of each fill/soil type are collected".

6.2.2 Waste Classification

For waste classification purposes, the RAP stated that sampling would be undertaken as follows;

- "Untreated material – stockpiled according to material type and sampled at one sample per 100 m³ or part thereof; and
- Treated material – stockpiled according to material type and sampled at one sample per 25 m³ for batches less than 100 m³ (up to 40 samples) and 1 sample per 50 m³ for batches over 1000 m³ (at least 20 samples)."

It was stated that liquid wastes would also be sampled for waste classification purposes, but no methodology or frequency of sampling was provided.

Auditor's opinion

The Auditor agrees with the frequencies proposed for sampling treated and untreated materials but requires that a strategy for sampling liquid waste at the Site be provided in the Sampling Plans for the validation works.

The Auditor requires that details of the waste classifications for materials at the Site be conducted in accordance with NSW DECC (2008) and be provided to the Auditor for review periodically throughout the remediation works or at stages in the remediation works where new waste classifications are conducted.

6.2.3 Imported Materials

The RAP stated that any materials imported to the Site should be virgin excavated natural materials (VENM) as defined by the NSW EPA (1999). It was further stated that imported materials would be sampled at a frequency of one sample per 100 m³ for volumes up to 1000 m³ (with a minimum of five samples per source site) and one sample per 250 m³ for volumes over 1000 m³ (with a minimum of five samples per source site).