

Auditor's opinion

The Auditor requires that in addition to the above, that materials imported to the Site should meet the requirements of NSW DECC (2008).

6.2.4 Beneficial Re-use

The RAP stated that the only excavated materials that would be considered to be suitable for beneficial re-use on-site would be required to have originated and remained on the Site and would need to meet the set criteria, as discussed in Section 6.1.2 of this SAR. The RAP stated that materials being considered for beneficial re-use on-site would be sampled at a rate of one sample per 25 m³ or part thereof for each material type.

Given the above, the RAP stated that materials taken off-site for treatment would not be returned to the Site and re-used.

6.3 Analytical Program

The RAP stated that the "analytical laboratories undertaking chemical analysis of samples must be accredited by the National Association of Testing Authorities (NATA) for each analytical method".

Auditor's opinion

The Auditor notes that the RAP did not provide a proposed analytical program for the validation of the Site. The Auditor requires that Sampling Plans for the validation of the Site present detail on the analytical program to be implemented for the sampling to be conducted during the remediation and validation works on the Site and to confirm that the methods and levels of reporting are in compliance with the requirements of NEPC (1999). The Auditor also requires that the Sampling Plans include detail on the laboratory/ies to be used during the remediation and validation works, their methods and limits of reporting for the analysis proposed and their quality assurance and quality control program.

6.4 Quality Assurance and Quality Control

The RAP stated that the quality assurance and quality control (QAQC) program for the remediation and validation works would include both field and laboratory components. The proposed QA/QC program presented in the RAP is summarised in Table 8 below.

Table 8: Summary of Proposed QA/QC program

Sample type	Frequency
Field duplicates / intra-laboratory duplicates	1 per 20 primary samples
Split duplicates / inter-laboratory duplicates	1 per 20 primary samples
Equipment rinsate blanks (excluding disposable items)	1 per piece of sampling equipment per day
Trip blanks	1 per sample batch
Spiked trip blanks	1 per sample batch (where volatile analysis requested only)

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Sample type	Frequency
Laboratory method blanks	Not specified
Laboratory duplicates	Not specified
Laboratory control samples	Not specified
Laboratory matrix spikes	Not specified
Laboratory surrogate spikes	Not specified

The RAP stated that an assessment of the "data quality and validity of the QAQC program" would be undertaken based on an evaluation of the Data Quality Indicators (DQIs) of Precision, Accuracy, Representativeness, Completeness and Comparability. It was stated that the DQIs would be required to be defined within the Sampling Plans and that achievement of the project DQOs would be required to be assessed against the DQIs for both field and laboratory procedures.

Auditor's opinion

The Auditor agrees that the DQIs for the works need to be developed with respect to the DQOs and that they be detailed within the Sampling Plans. The Auditor also requires that the Sampling Plans to be developed for the validation works include detail on both the field and laboratory QA/QC program in compliance with the requirements of NSW DEC (2006).

6.5 Validation Report

The RAP stated that a validation report would be completed in accordance with the NSW EPA (1997) and NSW DEC (2006). It was stated that the Validation Report would include the following:

- Details on the implementation of the RAP;
- Verification of regulatory compliance;
- A clear statement of whether the Site is considered suitable for its intended land use and whether it is considered to present an unacceptable risk to human health or the environment;
- Details of the long term EMP; and
- Any limitations, assumptions and uncertainties relevant to the conclusions of the report.

Auditor's opinion

In addition to the above, the Auditor requires that the validation report prepared for the Site include the characterisation of the materials retained beneath or surrounding the heritage structures on the Site and/or in areas of the Site at which validation criteria were not met and contaminated materials remained in-situ, including the analytical results, physical description and their potential to leach or volatilise. Detail must also be included on the type of physical barrier and marking layers that will contain the contaminated materials including its integrity and long-term stability.

The Auditor also requires that the validation report include detail on material tracking including waste classification and stabilisation and/or treatment activities undertaken during the remediation works.

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The Auditor also requires that the results of the pre-remediation and post-remediation groundwater monitoring be provided either within the validation report or within a separate report at the time of completion of validation report.

7.0 Long-term Environmental Management Plan

The RAP stated that the post-remediation long-term environmental management requirements for the Site would be documented within a long-term EMP that would be developed based on the results of the validation works. The RAP stated that the long-term EMP would address the requirements for management of potential ongoing risks to future users of the Site from the presence of residual contamination, the presence of heritage structures on the Site and the management of groundwater contamination. These matters are addressed below.

7.1 Site Users

The RAP stated that following remediation, potential exposure risks from residual contamination may exist at the Site. The RAP further stated that the long-term EMP would be used to detail procedures for undertaking works where these risk may be encountered (i.e. where an exposure pathway is completed). Specific details to be included in the long-term EMP with regard to the protection of future Site users were stated to be:

- "a permit and sign off protocol" to "enable those responsible for implementing the EMP to ensure all requirements of the EMP have been met for particular work tasks";
- "information that details specific limitations and controls on-site activities" particularly prohibiting the construction of basements, prohibiting the use of groundwater and controlling extracted groundwater from discharging from the Site; and
- "the location of contamination marker layers (if installed) and information on maintaining Site security".

7.2 Heritage Items

The RAP stated that the long-term EMP "will provide information specific to the limitations on development potential in the vicinity of the Southern Gasholder, based on the heritage value of this structure and the requirement to protect its stability and fabric". The RAP further stated that these limitations should extend to the western site boundary to minimise aesthetic impacts such as noise and visual impacts, on the neighbouring residential properties.

The RAP stated the following should be specifically considered:

- Landscaping and aesthetic considerations;
- Signage to notify Site users of the heritage value;
- Maintenance of a 'buffer zone' around the Southern Gasholder structure to minimise potential damage; and
- Prohibition of the use of heavy machinery and undertaking excavations in the buffer zone.

It was stated that a landscape design plan would be prepared prior to remediation, which was considered likely to address some of the above requirements.

7.3 Groundwater

The RAP stated that the EMP will contain a groundwater management plan (GMP) to "address risks from ongoing groundwater contamination". It was stated that the GMP would adopt MNA approach and would detail a groundwater monitoring and reporting program that would assess the effectiveness of the remediation of the Site in "achieving the management goals for groundwater" such that, over time, groundwater monitoring would be able to be ceased.

THE RAP stated that, using MNA, the success of soil remediation will be assessed based on the following:

- Reduction in the extent of the contamination plume;
- Reduction in contaminant concentrations in the plume; and
- Indications of naturally occurring degradation based on geochemical parameters.

The RAP stated that groundwater data collected pre-, during and post- remediation would be used to assess the progress of MNA. It was stated that an evaluation of the progress of MNA will assess:

- Plume stability – establishing whether the plume has reached equilibrium, is shrinking or declining;
- Statistical analysis – determine contaminants concentration trends over time, degradation rates and degradation products; and
- Baseline conditions – establish a benchmark to compare progress of MNA.

It was further stated that the disturbance of the ground during excavation works on the Site may potentially generate a short-term increase in concentrations of contaminants within groundwater, however, it was stated that the potential for this situation to occur was unknown and was unlikely to affect the required outcomes of MNA in the longer term.

7.3.1 Monitored Natural Attenuation

The RAP stated that the adoption of a MNA approach to the management of groundwater beneath the Site formed part of the overall remedial strategy for the Site and provided the basis for assessing the "success of site remediation goals relating to groundwater protection by source removal".

It was stated in the RAP that previous investigations indicated that there was the potential for MNA of hydrocarbon compounds in shallow and deep groundwater at the Site, based on concentrations of MNA parameters: sulphate, nitrate, dissolved oxygen, ferrous iron and methane. These results were presented in the RAP and are summarised in Table 9 below:

Table 9: Summary of MNA parameters

Parameter		Concentrations (mg/L)
Sulfate	Shallow	151
	Deep	613.3
Nitrate	Shallow	0.476
	Deep	0.012
Dissolved Oxygen	Shallow	2.03 – 7.43

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Parameter		Concentrations (mg/L)
Ferrous Iron	Deep	2.35 – 8.14
	Shallow	30.8
	Deep	18.7
Methane	Shallow	943.3
	Deep	50.67

The RAP stated that the natural attenuation processes likely to be occurring at the Site would include biodegradation (under both aerobic and anaerobic conditions, including respiration, denitrification, iron reduction, sulfagenesis and methanogenesis), dispersion, sorption and volatilization.

7.3.2 Groundwater Monitoring Well Network Design

The RAP stated that the network of groundwater monitoring wells to be used in the GMP for the Site included six existing wells located off-site and the installation of eight new nested wells on-site. The new nested wells would be installed to screen across perched groundwater in the shallow well (1–4 m bgs) and screen across deep groundwater in the deeper well (12–15 m bgs). It was also stated that consideration would be given to potential for ongoing source materials to be present in and around the Southern Gasholder when positioning well screens, particularly near the base where tar materials may have accumulated.

The locations of the new nested wells were presented on Figure 1 of the RAP (Attachment 1) and were located up- and down-gradient of contaminant source areas and on the down gradient boundary of the Site. It was stated the groundwater gradient was not expected to be altered by the remediation works.

The locations of the new wells was stated to be designed to allow for the assessment of groundwater conditions associated with residual tar impacts in remediated areas and to allow separate assessment of potential tar impacted material beneath the Southern Gasholder.

7.3.3 Groundwater Sampling and Analytical Program

The sampling and analytical plan to be adopted within the GMP for the program of MNA of groundwater at the Site was presented in the RAP is summarised in Table 10 below.

Table 10: Summary of MNA program

Stage	Number of wells	On/off Site	Monitoring period	Sampling frequency
1	6	Off site	Pre-remediation	Once
			During remediation	Monthly
			12 months post-remediation	Monthly
	16	On site	12 months post-remediation	Monthly
2	22	On and off site	Post remediation	Bi-annual
3	If required, following consultation with NSW DECC			

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The RAP stated that the groundwater analytical suite would be based on the contaminants of concern and MNA parameters, including metals (total arsenic, cadmium, total chromium, copper, lead, mercury, nickel and zinc), TPH, BTEX, PAH, phenols, ferrous iron, sulphate, nitrate and methane.

It was stated that the purging and sampling of groundwater monitoring wells would be undertaken using a "low-flow bladder technique". It was stated that the use of bailers would be considered if dewatering of the wells was required.

It was also stated that field measurements would be undertaken during each monitoring event, to assess standing water levels, water quality parameters (redox potential, electrical conductivity, temperature, pH, dissolved oxygen and physical observations) and hydraulic conductivity.

Auditor's opinion

The Auditor considers that the approach for the development of a long-term EMP for the Site as part of the remediation and validation strategy for the Site is appropriate as an effective means of ensuring that the use of the Site is restricted and that future users of the Site will be protected from potential exposure to contamination remaining on-site. The Auditor also considers the application of MNA in the GMP for the Site is appropriate given the CUTEP approach to the remediation of the sources of contamination on the Site. The Auditor considers that in addition to the groundwater analytical suite provided in the RAP, that groundwater should also be analysed for ammonia.

The Auditor requires that the long-term EMP for the Site is developed in accordance with the requirements of NSW DEC (2006) and includes the following:

- Objectives;
- Detailed description of the residual contamination present on the Site post-remediation, including the type of contamination, analytical results and location on the Site (including a plan prepared by a registered surveyor);
- Detailed description of the environmental controls that will be used to manage the residual contamination;
- Detailed description of responsibilities for implementing various elements of the provisions contained in the EMP;
- Timeframes for implementing various elements of the provisions of the long-term EMP;
- GMP is required to include detail on the following:
 - Justification of the management goals developed for groundwater at the Site;
 - A sampling, quality and analytical plan for required monitoring;
 - Appropriate monitoring locations and depth within and down-gradient of any residual contamination;
 - Relevant assessment criteria to be used in evaluating monitoring results;
 - Frequency of monitoring and reporting;
 - Methodology on how the results of the monitoring will be evaluated over time and how decisions will be made regarding the ongoing management strategy and how it will be demonstrated that groundwater monitoring and/or management under the GMP be ceased;

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