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1 Executive Summary

Background

This report presents the results of a human health and ecological risk assessment for the Former Gasworks Site of the property known as the Macdonaldtown Triangle, Erskineville, NSW (hereafter referred to as 'the Site'). The risk assessment has identified the potential issues that should be addressed in respect to contamination on the Site. Ground contamination that is present at the neighbouring former cleaning sheds site has been addressed in a separate risk assessment prepared by SKM (Macdonaldtown Triangle, Former Cleaning Shed Site, Human Health & Ecological Risk Assessment, August 2005).

The main tasks that have been undertaken as part of this assessment are as follows:

- An assessment of site conditions, which involved an evaluation of the main features of the site and its history;
- A review of previous investigations;
- Development of a site investigation methodology and quality assurance and quality control protocols;
- A preliminary assessment of the risks posed by ground contamination at the Site and identification of environmental investigation levels for assessing soil contamination, groundwater contamination, aesthetics, and soil-gas quality;
- A site-specific health and ecological risk assessment, which has involved hazard identification, toxicological assessment, human health exposure assessment and ecological risk characterisation; and
- Provision of conclusions and recommendations.

The Former Gasworks site along with the adjacent Former Cleaning Shed site is referred to as "The Macdonaldtown Triangle" and forms a 1.53 ha parcel of land. The Site is identified as Lot 50 in Deposited Plan 1001467 in the Local Government Area of City of Sydney Council, Parish of Petersham and County of Cumberland. The Site is generally bounded by railway and rail related activities to the north and east, the former gasworks site immediately to the south of the Site and Burren Street to the west.

Soil Contamination

The site-specific risk assessment involved the assessment of soil contamination data provided by previous investigations together with some additional data that targeted data gaps. The study has found that the fill layer is mainly contaminated with high levels of PAHs and TPH C10-C36 distributed over much of the site. In the fill layer, hot-spots were found to be contaminated by

benzene and xylenes in addition to PAHs and TPH C10-C36. Contamination in the fill layer was found to be highest in samples located near to the former tar tanks/gasholders, retorts/gas converter and the gas scrubbers.

The study found that the natural soils generally have lower levels of contamination compared to the fill layer and fewer hot-spots. Contamination in the natural soils was also found to be highest in samples located near to the former tar tanks/gasholders, retorts/gas convertor and the gas scrubbers.

Soil-Gas

The site-specific risk assessment involved the collection of field measurements of soil-gas vapour and computer analyses involving US EPA vapour transport models. Comparison of the results from the computer analysis and the field measurements showed that highly variable field results are to be expected given the highly variable volatile concentrations that have been measured in the shallow groundwater and unsaturated soils at the Former Gasworks site. The low soil gas levels measured in wells MW30-MW34 in March 2005 are consistent with the low groundwater concentrations that were measured in the last monitoring undertaken also in March 2005 and the low soil concentrations that have been measured in the plume area.

However, the computer analysis shows that much higher soil gas vapours may be present at the site than were measured by the investigation. This is because the results of the computer analyses show that much higher soil gas levels may occur if the higher volatile concentrations measured in the earlier groundwater monitoring rounds and/or higher soil concentrations measured in some shallow soil samples are more representative of site conditions. Due to this high degree of variability, there is potential for elevated levels of soil gas vapours to be emitted from the ground surface of the site and the exposure pathway from volatile soil vapours needed to be included in this risk assessment.

The analysis also showed that the primary source of BTEX in the soil vapour at the volatile plume area is likely to be from the shallow groundwater, since no significant BTEX levels have been measured in the shallow soils. On the other hand, the analyses showed that the primary source of the six target PAHs in the soil vapour at the volatile plume area is likely to be from the unsaturated shallow soils, due to the relatively higher PAH concentrations in these soils compared to the shallow groundwater.

Groundwater Contamination

The site-specific risk assessment involved the collection of a third round of groundwater monitoring data, which was combined with the data obtained by previous investigations. The study has found that high levels of light-end petroleum hydrocarbons (TPH C_6-C_9 and BTEX) and light-end PAHs (naphthalene, acenaphthalene, fluorene, pyrene) are present in the groundwater at locations close to the former gasworks, in the vicinity of the former gasholders and location of

possible tar tanks. Although high concentrations of low-end hydrocarbon contamination were recorded during previous investigations at the Former Gasworks site, minimal middle to high-end contamination was detected by the additional investigation conducted by SKM. Heavy metal contamination at the Former Gasworks site is widespread with concentrations elevated above ANZECC (2000) trigger values for 95% level of protection for freshwater aquatic ecosystems. The highest concentrations were recorded at locations near to the former gas production process areas.

Site Contamination Model

The main contaminants of concern for a site-specific risk assessment at the Former Gasworks site are PAH compounds (particularly naphthalene and benzo(a)pyrene), benzene, ethylbenzene, xylenes and the heavy metals cadmium, copper, lead, nickel and zinc. The environmental media of concern are the fill layer, the underlying natural soils, groundwater and soil gas.

The conceptual site contamination model identified the potential receptors of ground contamination from the Former Gasworks site to be:

- Future long-term commercial/industrial users of the Former gasworks site (RailCorp workers);
- Future maintenance / construction workers at the Former Gasworks site and surrounding areas;
- The community who live in residential land adjacent to the western boundary of the site, off-site construction workers and users of any groundwater extracted from wells down-gradient of the site; and
- Freshwater aquatic ecosystems in the headwaters of Alexandra Canal.

The main exposure pathways for future long-term site workers at the Former Gasworks site are considered to be:

- Ingestion and dermal contact with contaminated surface soils;
- Inhalation of vapours emitted into the outdoor air and indoor air (within buildings) generated by contaminated soils in the unsaturated zone above the shallow aquifer; and
- Inhalation of vapours emitted into the outdoor air and indoor air (within buildings) generated by contaminated groundwater in the shallow aquifer.

The main exposure pathways for construction workers at the Former Gasworks site are considered to be the same as those for long-term site workers plus the ingestion and dermal contact with contaminated groundwater. This additional exposure pathway has been included because of the potential for excavations to extend deeper than 1.5m and past the shallow aquifer water table. Construction workers at the site may also be subjected to volatile soil gas vapours and inhalation of dusts, particularly when excavating in highly contaminated areas such as near areas that contained tar pits, retorts and gasholders. However, the site-specific risk assessment did not include these

exposure pathways since these health risks should be managed as part of an occupational health and safety plan covering any earthworks conducted at the Former Gasworks site.

The main exposure pathways for residents and off-site construction workers at properties surrounding the Former Gasworks site are considered to be:

- Ingestion and dermal contact with contaminated groundwater;
- Inhalation of vapours emitted into the outdoor air and indoor air (within buildings) generated by contaminated soils in the unsaturated zone above the shallow aquifer; and
- Inhalation of vapours emitted into the outdoor air and indoor air (within buildings) generated by contaminated groundwater in the shallow aquifer.

The main exposure pathways for the freshwater ecosystems in the headwaters of Alexandra Canal are considered to be the extraction and discharging of contaminated groundwater to the stormwater system that would be discharged into the headwaters of Alexandra Canal.

Health Risks to On-site Construction Maintenance Workers

The site-specific risk assessment found that there is potential for on-site construction/maintenance workers at the Former Gasworks site to be exposed to a high risk of health impacts from ground contamination if working in an unremediated environment with no personal protective equipment (PPE) or special work procedures. The hazard quotient was calculated to be 6.6, which exceeds the acceptance criteria of 1. The main health risks are posed by workers exposed to PAHs and petroleum hydrocarbon contamination, which occurs both in the shallow soils and groundwater.

In order to mitigate these risks, it will be necessary for work procedures to be adopted by on-site construction/maintenance workers at the Former Gasworks site that will minimise/avoid:

- Dermal contact with contaminated groundwater;
- Physical contact with the surface soils;
- Dust generation; and
- Require high levels of hygiene and decontamination.

A program of environmental monitoring should also be undertaken when any construction work or significant maintenance work is undertaken at the Former Gasworks site. Alternatively, consideration should be given to capping the contaminated soils with a clean-soil cover or pavement.

Health Risks to Long-Term Site Workers

The site-specific risk assessment found that there is potential for long-term site workers at the Former Gasworks to be exposed to an unacceptable health risk from ground contamination if

working in an unremediated environment with no personal protective equipment (PPE) or special work procedures. The hazard quotient was calculated to be 2.95, which exceeds the acceptance criteria of 1. The main health risks are posed by long-term site workers exposed to high concentration of PAHs and TPH C_{10}-C_{36} that have been detected in fill materials in the tar tank/gasholder area on the Former Gasworks site.

In order to mitigate these risks, it will be necessary for work procedures to be adopted by long-term Site Workers at the Former Gasworks site that will minimise/avoid:

- Physical contact with the surface soils;
- Dust generation; and
- Require high levels of hygiene and decontamination.

Alternatively, consideration should be given to capping the contaminated soils with a clean-soil cover or pavement.

Health Risks to Nearby Residents and Off-site Construction Workers

The site-specific risk assessment found that nearby residents would face a low risk from contamination present at the Former Gasworks site provided:

- Access to the Former Gasworks site is restricted to authorised personnel, who would largely be on-site workers; and
- Licensed groundwater extraction does not occur in the area;

The site-specific risk assessment found that off-site construction workers should face a low risk from working in deep excavations at nearby residential sites and that no restrictions should be required to manage construction works at these properties.

Phytotoxic Impacts to Future Landscaping at the Site

The investigation found there is a risk that some heavy metal contaminants may affect the health of plants that are grown at the Former Gasworks site in the fill soils. To address these risks it is recommended that:

- Landscaping areas be formed in areas where there is a 1-2m thick layer of clean soil that is conditioned to be suitable for plant growth; and/or
- Native plants be used at the site having a tolerance of elevated heavy metal concentrations.

These recommendations should be included in a long-term SMP that will need to be placed on the Former Gasworks site.

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Aesthetic Assessment

This study considers there is a low risk of aesthetic issues affecting the future use of the Former Gasworks site provided the site continues to remain commercial/industrial land and any site works are undertaken in a manner that properly manages the aesthetic impacts associated with subsurface materials at the site. A long-term SMP will need to be placed on the Former Gasworks site in order to ensure that any future works are undertaken in a manner that properly manages the aesthetic impacts associated with subsurface materials at the site.

Need for Remedial Works

This site-specific health risk assessment has concluded that contamination at the Former Gasworks site would present an unacceptable health risk to long-term site workers and construction/ maintenance workers undertaking work at the site. The main causes of the elevated health risks are from exposure to contaminated surface soils together with exposure to contaminated groundwater for the case of a construction/maintenance worker working in wet conditions at the site. These risks could be reduced to acceptable levels if a program of remedial works were carried out at the site. Alternatively, access to the Former Gasworks site should continue to be restricted.

Recommendations

It is recommended that access to the Former Gasworks site should continue to be restricted if no redevelopment of the site is proposed in the near future. However, if the site is to be redeveloped and used for ongoing commercial/industrial land use, it is recommended that a program of on-site remedial work be undertaken.

The remedial work should at a minimum involve the capping or removal of contaminants in the upper 0.5m of soil across the site. Consideration should also be given to the removal of ongoing sources of groundwater contamination such as in the suspected area of the former tar tanks and sludge in the gasholder base. A long-term SMP should also be prepared and used to manage activities at the site in order to ensure the risks posed by contamination are properly managed. The issues that the SMP should address include among other things are:

- A prohibition on the extraction and reuse of groundwater at the Former Gasworks site and a prohibition on the construction of drained basements or deep pits that intersected the groundwater table. These restrictions are required to ensure that the risk to long-term site workers from ingestion or dermal contact with contaminated groundwater remains low;
- The requirement for an occupational health and safety plan to be prepared and implemented for any earthworks conducted at the Former Gasworks site. This requirement is needed in order to ensure on-site construction/maintenance workers and long-term site workers are not subjected to volatile soil gas vapours and dust levels that exceed OH&S standards;

- The erection and maintenance of security fencing and controlling site access to ensure that the risk to the surrounding residential community from on-site soil contamination remains low. This requirement may not be required if remedial works are conducted at the Former Gasworks site;
- Any groundwater intercepted by on-site construction works would need to be managed within the Former Gasworks site. This requirement is needed to protect freshwater ecosystems in the headwaters of Alexandra Canal;
- Landscaping areas should only be formed in areas where there is a 1-2m thick layer of clean soil that is conditioned to be suitable for plant growth;
- Native plants should be used at the site having a tolerance of elevated heavy metal concentrations; and
- Any future works at the Former Gasworks site should be undertaken in a manner that properly manages the aesthetic impacts associated with subsurface materials at the site.