

Date: 30 November 2018

Ms Erin Barker
Unit Head – Sydney Industry
NSW Environment Protection Authority
Level 13, 10 Valentine Avenue
Paramatta NSW 2150

Dear Erin,

RE: Kendall Bay Sediment Remediation Project (SSD 6701) – EPA Submission on Environmental Impact Statement.

Introduction

The NSW Department of Planning and Environment (DP&E) provided Jemena Limited (Jemena) with a letter prepared by the NSW Environment Protection Authority (EPA) dated 6 November 2018 (Document reference: DOC18/826180). The letter contained the EPA's comments on the Environmental Impact Statement for the Kendall Bay Sediment Remediation Project. The letter from the EPA is provided as **Attachment A** in this letter.

Jemena has prepared this letter, with input from its consultant/specialists and remediation contractor as required, to response to the comments presented in the EPA's letter. The response to the EPA's submission is provided below.

Response to Submission

Jemena is committed to managing the remediation process implementation of detailed mitigation measures which will be contained within the Remediation Works Environmental Management Plan (RWEMP), the Remedial Work Plan (RWP), and Validation Sampling Analysis and Quality Plan (VSAQP) as well as a number of other documents as described in EIS Chapter 18. These documents are still to be completed.

The 16 headings below correspond to the points listed in the EPA letter. Jemena provided an initial email response to the EPA on 9 November 2018 and met with the EPA and DP&E on 27 November 2018. The responses below contain information from the email and the meeting where relevant.

Response to EPA Comment 1 and 2: Derivation of Construction Project Specific Noise Management Levels

The logger location L6 (measured by ERM) does exhibit signs of being affected by extraneous ambient noise. It is likely that the measurements were influenced by local construction activity occurring at the time. Nevertheless, we consider the logger results to be representative of the ambient noise levels during the measurement period and can be relied upon. Furthermore, note that the derived management levels for L6 presented in Tables 5-1 and 5-2 are similar to the other measurement locations and therefore unaffected by the extraneous peak noise level events measured at the time.

Response to Comment 3: Clarification of Remediation Areas

Jemena initial email response 9 November 2018: Addressed in Section 11.2.4 of SAR, in particular “CSIRO concluded that it would be ineffective to target areas of the bay where chronic (nonlethal) toxicity is observed because sediments throughout the Parramatta River are known to exhibit chronic toxicity due to elevated levels of heavy metals and other contaminants.”

EPA subsequent comment email 21 November 2018: On the basis of the site auditor approval, the EPA supports the management approach outlined in the RAP. However, the EPA would prefer Jemena to make it clear that the chronic toxicity has been addressed but will not be targeted based on sustainability reasons that are endorsed by the Site Auditor.

Jemena response as discussed in meeting 27 November 2018: Jemena confirms remediation of chronic toxicity was specifically investigated by the CSIRO and was considered to be ineffective based on sustainability considerations which are endorsed by the Site Auditor. CSIRO also concluded targeting gasworks-contaminated sediments likely to cause acute toxicity could significantly improve the health of benthic communities within Kendall Bay.

Response to Comment 4: Clarification of Remediation Areas

Jemena initial email response 9 November 2018: Jemena confirm that the Northern Remediation Area includes the areas marked as NA1, NA2 and NA3 and all of the areas within the light blue dotted line referred to as the “intervening area” in the RAP (Refer to figure provided in **Attachment B**). Section 7.6.2 of the RAP states “The joining of the two areas NA2 and NA3 and the intervening area between them was based on the similarities of conditions within and between the areas and the dispersed nature of the sampling sites, with exposed contamination at the surface, often surrounded by non-contaminated sediments”.

EPA subsequent comment email 21 November 2018: Please confirm the scope of works proposed for remediation between the areas NA1, NA2 and NA3.

Jemena response as discussed in meeting 27 November 2018: The ‘intervening area’ has the same scope of works proposed as the areas shown as NA2/NA3 (i.e. in situ stabilisation and capping layer). Reference to NA2 and NA3 in the RAP and EIS includes the ‘intervening area’.

Response to Comment 5: Outcomes of the Kendall Bay Remediation Field Trial

Jemena initial email response 9 November 2018: Interim Auditors Advice (IAA) provided 8 November 2018 which concludes that the outcomes of the trials are consistent with the objective of the VMP and have demonstrated the practicality and applicability of the remedial strategy to Kendall Bay. The multiple lines of evidence have demonstrated the success of in-situ stabilisation under field conditions and the Auditor agrees that the project should progress to full scale.

Response to Comment 6: Validation, Sampling Analysis and Quality Plan

Jemena initial email response 9 November 2018: As confirmed in conclusions of the IAA sent 8 November 18, the VSAQP will be prepared by the validation consultant and reviewed by the Site Auditor before being provided to the EPA.

Response to Comment 7: Long Term Environmental Management Plan

Jemena initial email response 9 November 2018: Section 11 of the SAR addresses the cap thickness and in particular the Auditor's Opinion in Section 11.4 where it states "...the Auditor is of the opinion that based on the data reviewed, and considering the multiple lines of evidence and ESD principles applied, that this change in depth did not have a material impact on the areas determined to require remediation to address ecological risk". Section 16 of the SAR addresses the SMP, with the Auditor stating the requirements will be determined by the outcome of the field trial and by the subsequent validation of the full scale works. As stated in the EIS the requirements of the SMP are yet to be confirmed and will be determined in consultation with RMS, EPA and the site Auditor.

EPA subsequent comment email 21 November 2018: An environmental management plan is required to address the long term management of the entire declaration area in perpetuity. The EMP should also include contingencies for anthropogenic or natural disturbance of the remediated areas.

Jemena response as discussed in meeting 27 November 2018: As discussed during the meeting, two EMP/SMPs are anticipated to be required, one to cover the remediation areas (Northern and Southern Remediation Areas) and one to cover the remainder of the current declared area (which is planned to be reduced).

Jemena, EPA and RMS are currently in discussions to determine the appropriate management/maintenance instrument for the remainder of the declared area and any SMP/EMP that may be required.

Section 16 of the SAR addresses the SMP for the remediation areas, with the Auditor stating the requirements will be determined by the outcome of the field trial and by the subsequent validation of the full-scale works. As stated in the EIS the requirements of the EMP/SMP are yet to be confirmed and will be determined in consultation with RMS, EPA and the Site Auditor. The VSAQP is to be prepared by the validation consultant and reviewed by the Site Auditor in early 2019 will include an indicative SMP with the items required in the SMP to be confirmed upon completion of remediation works and review of the validation report.

Response to Comment 8: Acid Sulphate Management Plan

Jemena initial email response 9 November 2018: The validation consultant will prepare an Acid Sulphate Soil Management Plan (ASSMP) prior to the works which includes treated and untreated material. Please refer to section 6.4 of IAA (8 November 2018), "The data for the treated samples indicates the buffering capacity of the cement exceeded the potential for acid generation...". The Auditor states that this appears reasonable based on the information reviewed. This buffering capacity was discussed during the meeting between EPA and Jemena on 22 October 2018 prior to provision of the IAA to EPA.

EPA subsequent comment email 21 November 2018: The buffering capacity of the cementitious product is acknowledged. However, the EPA has not seen any data associated with the expected oxidation of

untreated sediment. Prior to the commencement of works, the proponent must demonstrate that the remediation can be undertaken without the generation of acidic leachate.

Jemena response as discussed in meeting 27 November 2018: An ASSMP is being prepared by the validation consultant and will be reviewed by the Site Auditor (Q1 2019). The ASSMP will address expected oxidation of untreated sediment. The validation consultant is planning sampling and analysis from the beach area later this year (2018) to inform the report.

Response to Comment 9: Waste Management

The remediation contractor will prepare a comprehensive waste management plan detailing the waste classification and handling procedures for all waste streams generated during the Project. It is intended that the waste materials will be loaded onto trucks for off-site disposal as soon as practical. However, the capacity of the Staging Site is considered more than sufficient to meet the requirements for temporary storage of waste prior to off-site disposal if required.

Two large warehouse facilities and an exterior concrete slab are available at the Staging Site to temporarily store waste in sealed bins prior to offsite disposal, if required.

The approximate dimensions of the Staging Site are provided below:

- Combined warehouse and office area: 1,230 m²;
- Warehouse area: 1,080 m²;
- Staging site (whole site): 3,330 m²;
- Wharf area: 630 m².

The excavated sediment requiring off-site disposal from remediation area SA1 And NA2/NA3 will arrive to the Staging Site on barges in sealed bins and the bins will remain sealed until loaded onto trucks for off-site disposal. A portion of the exterior northern concrete slab will need to be kept clear to enable trucks to manoeuvre in this area of the site. Based on the estimates of area provided above, the estimated excavation rate from Kendall Bay (early estimate ~80m³/day) and the expected dimension/capacity of the sealed bins based on preliminary designs (fill capacity 2m³/4.6T), the Staging Site provides sufficient capacity for a week of waste material during excavation if required. The storage capacity at the Staging Site is not intended be an issue, with the limiting factor being the number of 2m³ waste bins available for the works which will drive regular disposal of waste material.

As discussed above, the excavated material requiring off-site disposal from remediation area SA1 and NA2/NA3 will arrive in sealed bins to the Staging Site and remain sealed until taken off-site therefore greatly limiting the potential for odour generation. Additional odour management activities proposed are described in the EIS in section 8.10, and include:

- cleaning the exterior of the bins as needed;
- Prepare and implement an Air Quality Management Plan, including monitoring;
- only excavate / expose the minimum area of sediment necessary at any one time to limit the volume of stored material; and,
- cover each skip bin of excavated impacted material immediately once filled.

It is noted that other materials will also be stored at the Staging Site. These include clean capping materials (sand and cobbles etc.), carbon mat, treatment reagents (i.e. cement and other mix modifiers such as

sodium silicate, anti-washout, superplasticiser etc.) and low level waste materials that are non-odorous (i.e. sand with coke and ash removed from Remediation Areas SA3, SA4 and SA5. These materials are considered naturally immobilised.

Odour modelling has been undertaken for the odour generation potential at the Staging Area as shown in section 8.6 of the EIS.

Response to Comment 10: Water Management – Northern Area

The EIS states that the need for sheet piles at NA2 and NA3 will be assessed following the field trial. As described in the Trial Report (Ventia, 2018), the environmental controls tested in Phase 2 of the trial were a moon pool/silt curtain and in Phase 3 sheet piles/silt curtain. The trial showed that the moon pool/silt curtain were successful in controlling turbidity from the mixing work, however required more time consuming maintenance and therefore sheet piles are now considered likely to be adopted for NA2 and NA3 for the full scale works.

Ventia are currently reviewing the detailed design to be applied for sheet piles for NA2 and NA3. The sheet pile design for remediation areas SA1 and NA2 and NA3, has not considered the requirement for sealing clutches between the sheet piles in the wall. It is noted that the sheet piles are not designed to act as a cofferdam but rather to provide mass containment of the impacted sediments located inside this structure.

The sheet pile design is required to provide relief in certain areas of the sheet pile wall to prevent excess loading from higher water level on one side of the wall compared to the other side of the wall. The approach to the works is consistent with several other large sediment remediation projects delivered by Ventia (and endorsed by the NSW EPA) in NSW including the Homebush Bay Sediment Remediation Project in Sydney (including Allied Feeds and Lednez Remediation Projects) and the Hunter River Sediment Remediation Project in Mayfield. Modifying the design to allow for sealed clutches, would require a complete re-think of the approach to the remediation of contaminated sediments on this project. The difficulties that are presented by the sealing of clutches in the wall are as follows:

- The depth of stiff clay foundation materials (i.e. material required to support the foundation of the wall) in remediation area NA2 and NA3 is not sufficient to support a coffer dam structure. Therefore, the requirement for significant bracing and other structural supports would be required. This bracing and structural supports i.e. props and waler beams etc. would prevent access to the remediation work area and significantly challenge the installation and removal of this wall and the delivery of the ISS of sediments once the wall was constructed;
- The installation of a coffer dam structure would be cost-prohibitive and take a significantly longer duration to install / remove;
- Significantly larger plant and equipment would be required to install a coffer dam structure. This plant and equipment would also be challenged by access constraints presented by the shallow waters of Kendall Bay, where shallow draft barges are required to gain access to the work areas, during the installation and removal of a coffer dam structure;
- Significant increase in noise and vibration would be required to pre-drill and drive larger piles into the rock; and
- This approach would also impact the stability of the seawall, due to increased vibration, on the boundary of Kendall Bay.

The existing mass containment sheet pile wall structure was tested in the recently completed field trial. The field trial indicated that the sheet pile design provided for mass containment of the impacted materials and provided an adequate primary control for turbidity from the mixing works. The design for the full-scale

works will be provided in the Remedial Work Plan (RWP) to be reviewed by the Site Auditor (expected early 2019).

Please refer to Section 9 of the trial report for further information/assessment of the environmental controls used during the field trial.

Ventia and Jemena believe this mass containment structure would provide an interlocked containment structure which is suitable for the containment of these impacted sediments. Any leakage of dissolved contamination is expected to be minimal and not generate impacts exceeding the Australian & New Zealand Guidelines for Fresh and Marine Water Quality 2018 water quality guidelines. Water sampling by the Validation Consultant during the remediation works will confirm impacts are negligible and ongoing observations of water discoloration and plumes outside of the sheet pile wall will be recorded and presented to the NSW EPA during the delivery of the works.

Jemena initial email response 9 November 2018: The EIS states that the need for sheet piles at NA2 and NA3 will be assessed following the field trial. As described in the Trial Report, the Environmental controls tested in Phase 2 of the trial were a Moon Pool/Silt curtain and in Phase 3 Sheet Piles/Silt Curtain. The trial showed that the moon pool/silt curtain were successful in controlling turbidity from the mixing work, however involved more maintenance and therefore sheet piles are being considered for NA2 and NA3 for the full scale works. The proposed design for the full scale works will be provided in the Remedial Work Plan (RWP) to be reviewed by the Site Auditor. Please refer to Section 9 of the Trial report (as provided on 22 October 18) for further information/assessment of the Environmental Controls used during the field trial.

EPA subsequent comment email 21 November 2018: The EPA reiterates the position it put forward in its letter to DPE dated 6 November 2018, that is, if the proponent is considering an alternate primary control that is not solid for the full depth of the water column, then detailed water quality monitoring results must be provided to the EPA to demonstrate an equivalent level of environmental protection. Turbidity is one point of consideration. The EPA is looking to understand how free phase components are distributed in the remediation area.

Jemena response as discussed in meeting 27 November 2018: Noted. Sheet piles are considered likely to be adopted for NA2 and NA3 for the full scale works given feedback from the remediation contractor and with consideration of the EPA's comments. The remediation contractor is currently reviewing the design for sheet piles in the northern remediation area. The proposed design for the full scale works will be provided in the Remedial Work Plan (RWP) which is being developed by the Contractor.

Response to Comment 11: Water Management – Silt Curtains

The primary control (sheet piles) and secondary control (outer silt curtain) will remain in place throughout the ISS mixing and excavation works. Please find attached a figure showing the expected positioning of the outer silt curtain. Note that the plan is to have an open gate in the silt curtain and sheet pile wall away from the mixing works and positioned to minimise tidal flows and wind generated currents in and out of the silt curtain while optimising vessel access to and from the work area. The gate in the silt curtain and sheet pile wall will be closed during out of work periods (i.e. overnight, weekends or other periods where no vessel access is required). An open gate in the silt curtain and sheet pile wall is required to enable the works to progress efficiently.

Several bubble barriers across the gates are currently being designed to allow continuous vessel movements into and out of the work areas during operations. The barrier would consist of a single row of air bubbling to the surface and forming a barrier line on the surface of the water with air supplied from a

barge mounted compressor, or similar. Bubble barriers have been in use for over 50 years worldwide for control of oil and turbidity as both permanent and temporary installations, first locally installed in Fremantle WA in 1970 at 290m long. Most recently a bubble barrier was used by Boskalis during the Port Kembla Dredging operation for the hopper barge access gate in a 1100m Adiemas silt curtain around the spoil ground in the outer harbour. The operation of the bubble barrier consists of compressed air delivered to a sub-surface perforated pipe that creates an underwater bubble curtain. The curtain effectively contains turbid and oily waters inside the remediation zones, but allows easy access for barge movements. The silt curtain design takes into consideration the dominant tidal conditions and currents, and allows for simplified access and egress for barges to the remediation works, but still maintains a high degree of control over potentially turbid waters.

Turbidity monitoring (visual and water quality meter) adjacent to the gate is proposed and will be further described in the Water Quality Management Plan.

Response to Comment 12: Water Management – Concrete batching

Jemena confirm that fly ash is not proposed to be used in the ISS mixture. Ground granular blast furnace slag (GGBFS) is a common component of marine cement and therefore will be present in the ISS mixture for the remediation works within Kendall Bay. Given the common presence of blast furnace slag in marine cement it has been used widely in marine structures across Australia and internationally.

The WQMP will address the items listed above. Visual monitoring for pipe breakages or leaks as well as monitoring of pressure in the lines is proposed i.e. changes in pressure could signal a blockage or leak in the grout delivery line. Emergency response procedures/processes will be implemented and documented as necessary.

Response to comment 13: Proposed Water Quality Criteria

- a) Monthly water sampling is proposed to be undertaken by the validation consultant. The sampling will be described in the VSAQP and WQMP. The VSAQP will be provided for review by the Site Auditor. The list of analytes will be agreed in consultation with the Site Auditor and EPA. Further information regarding chemicals associated with the ISS mixture is provided in response to item d) below.
- b) Jemena's validation consultants have been engaged to undertake monthly water sampling, however Jemena acknowledge EPA's request to undertake weekly water sampling during new marine remediation activities. Jemena would consider it appropriate to undertake weekly water sampling during the first month of the ISS mixing works. Further information on proposed timing of water sampling events will be provided in the VSAQP to be provided for Site Auditor review.
- c) Noted. To be included in the VSAQP and/or WQMP. It is noted that the results from the laboratory analysis will take numerous days to be available and therefore the ability to use visual and real-time data where possible is preferred (i.e. turbidity meter).
- d) The proposed ISS mixture to be taken forward to the full scale remediation works comprises off the shelf marine cement. The use of sodium silicate and anti-washout is also being considered. The MSDS for these components are provided in **Attachment C**. These where the components used during the recent field trial and water quality monitoring during Phase 3 trial and at completion of the trial can be provided on request.

Response to Comment 14: Water Management – Turbidity

- a) The SWA proposes a trigger value for TSS of 50 mg/L above background levels and turbidity of NTU value equivalent to 50 mg/L TSS above background levels. Prior to the field trial within Kendall Bay the validation consultant (WSP) undertook water monitoring of Kendall Bay and adjacent bays and reviewed previous monitoring reports. A background turbidity value of 50 NTU was adopted for the trial, based on the ANZECC Lowland Rivers criteria. The field trial indicated that the turbidity of Kendall Bay is greatly affected by factors outside the remedial works, particularly in the southern portion of the bay. For example, during times when no remedial activity was being undertaken the turbidity in the southern portion of the bay can exceed 50 NTU during low tide and is influenced by factors such as prevailing wind direction and waves from passing ferries. Following the results from the trial it is considered appropriate to have a mechanism to re-establish the background turbidity level at a location relevant to the monitoring location but outside the influence of the work activities. This procedure will be documented in the WQMP.
- b) Ventia are currently considering automated continuous turbidity monitoring linked to an automated alert system. The proposed monitoring will be defined in the WQMP and will include visual inspections, reactive water sampling as needed and procedures for conditions which may result in increased turbidity not associated with remediation works. It should also be noted that placement of the turbidity monitor within 5 metres of the secondary silt curtain will be problematic as during low tide conditions the continuous monitoring buoys would impact the silt curtain and create false readings. It is proposed that any monitoring system is located at least 10 metres away from any environmental controls.

Response to Comment 15: Waste Water Management

Offsite disposal of wastewater is the nominated primary option. There are no plans to discharge collected waste water to Parramatta River. Should discharge to Sydney water sewer or Parramatta River be necessary, no discharge to the Sydney Water sewer or Parramatta River will be undertaken until such time as a trade waste agreement or an environment protection licence (as applicable) is granted. The application process will define the minimum treatment and testing requirements that Sydney Water or the EPA require to facilitate discharge.

Response to Comment 16: Air Quality – Odour Management

The operating hours for the remediation project are 7am to 5pm Monday to Friday, and 8am to 1pm Saturday.

The modelling was conducted per two time schedules, depending on the sources;

1. For sources that would emit at all/most times, such as the surface of the water, the emissions were modelled for all hours of the year.
2. For intermittent sources of emissions, such as associated with the active remediation activities, the emissions were modelled between 7am to 6pm on every day. The extra hour of emissions in the evening was included deliberately to consider any lingering/ residual end of day effects, adds conservatism and deals with daylight savings issues.

Closing

Yours sincerely

A handwritten signature in blue ink, appearing to read 'Phil Hutson', with a stylized, flowing script.

Phil Hutson

Project Manager, Kendall Bay Sediment Remediation Project



EPA Ref. DOC18/826180

Ms Deana Burn
320 Pitt Street
SYDNEY NSW 2000

Email: deana.burn@dpe.nsw.gov.au

Dear Ms Burn,

Kendall Bay Sediment Remediation Project (SSD 6701)

I refer to the NSW Department of Planning and Environment's ("DPE") letter dated 29 September 2018 inviting the NSW Environment Protection Authority ("EPA") to comment on the Kendall Bay Sediment Remediation Project.

The EPA has reviewed the associated Environmental Impact Statement and determined that, in order to complete the assessment, further information is required. See Attachment A for details.

Until the matters detailed at Attachment A have been addressed, the EPA is unable to make an informed recommendation regarding the proposed development. The documents that the EPA has reviewed are detailed at Attachment B.

Representatives from the EPA are available to meet with DPE and the proponent to discuss this request for additional information. Please forward any additional information by email to metro.regulation@epa.nsw.gov.au.

If you have any questions in relation to this letter, please contact Tenille Lawrence on 9995 6207 or tenille.lawrence@epa.nsw.gov.au.

Yours sincerely

A handwritten signature in black ink that reads "Erin Barker". The signature is fluid and cursive.

ERIN BARKER
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NSW Environment Protection Authority

6 November 2018

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ATTACHMENT A – Further Information Required

Derivation of Construction Project Specific Noise Management Levels

1. The *Predicted Scenario Noise Levels*, provided in Appendix B of the Environment Noise Impact Assessment, shows unattended noise monitoring location (L6) is not situated at the nearest affected receiver to the Staging Area.

Recommendation:

The proponent should provide justification that noise measured at this location is representative of noise at the nearest affected receiver.

2. Although maximum noise level data is not relevant for establishing construction noise management levels, maximum noise level ($L_{A,Max}$) results in the graphical noise monitoring for L6 are inconsistent with what would be expected when compared with other locations.

It is not clear if the maximum noise level measurements are valid or whether an error occurred during data processing resulting in erroneous data being presented in the report.

Recommendation

The proponent needs to clarify why the maximum noise level data at L6 is inconsistent with other comparable noise monitoring locations to provide the EPA with assurance that noise levels measured at L6 can be relied upon to determine construction noise management levels.

Clarification of Remediation Areas

3. In addition to the documents submitted as part of the development application for the project, the EPA has reviewed the Site Audit Report, *Remedial Strategy Kendall Bay Remediation Project* prepared by Ramboll Australia Pty Ltd, dated July 2018 (“**SAR**”).

The CSIRO was engaged to investigate the chemical bioavailability and toxicity of contaminants within the sediments at Kendall Bay and to provide advice on the development of appropriate remediation targets that were protective of benthic communities including assessment of both acute and chronic toxicity.

The SAR reports the accepted site specific ecological remediation criteria developed by CSIRO (2016)¹ as:

maximum **PAH**² <60mg/kg, average PAH <25 mg/kg,
maximum **TPH**³ <5500 mg/kg and average TPH <4000 mg/kg.

CSIRO (2016) also stated that the remediation should eliminate the contact by benthic organisms or physical disturbance (to a depth of 50 cm) of such sediments.

The *Kendall Bay Remediation Action Plan*, dated June 2018 and prepared by Synnot Wilkinson (“**RAP**”) and Kendall Bay RAP Addendum prepared by Ian Swane and Associates, dated 22 June 2018 (“**RAP- Addendum**”) propose that the sediments to be remediated are those that:

¹ Simpson, S.L, Spardaro, DA and Batley, GE (2016) *Development of remediation targets for Kendall Bay Sediments – Bioavailability and Ecotoxicity of contaminants*. CSIRO Land and Water Report EP162025, April 2016.

² Polycyclic Aromatic Hydrocarbons

³ Total Recoverable Hydrocarbons

- exceed accepted site specific ecological remediation criteria
- that are acutely toxic or lack benthic fauna or have gasworks waste at the near surface
- are within the top 300 mm because “this represent the depth where most benthic organisms live”⁴.

The remediation criteria listed within the RAP and the RAP- Addendum differ from the EPA requests⁵ that both acutely and toxic sediments are remediated. The reason for this difference is not clear.

Recommendation

Clarify the reason why the remediation criteria listed within the RAP and the RAP- Addendum differs from the EPA request that both acutely and toxic sediments are remediated.

4. Although the remediation site identified within the Declaration of Remediation Site⁶, includes all sediments which fall within 200m from the land-based boundary, the RAP proposes to actively remediate the area north of the former cargo loading dock (3,604 m²) which has the highest concentrations of contaminants and the southern ‘beach area’ (10,017 m²) which is where the greatest human exposure occurs.

The proposed active remediation areas are further refined in the RAP-Addendum which delineates:

- the former cargo loading dock (north remediation area) into three sub-areas: NA1, NA2 and NA3
- the southern ‘beach area’ (southern remediation area) into five sub-areas: SA1, SA2, SA3, SA4 and SA5.

According to the RAP-Addendum:

- PAH concentrations are expected to exceed site specific remediation criteria in several locations beyond the proposed ‘active remediation’ areas, with a maximum PAH concentration anticipated after remediation of 228 mg/kg⁷.
- The average total PAH concentration are expected to exceed site specific remediation criteria (of 25 mg/kg) in 11 of 43 sub-areas of the declared significantly contaminated sediments after the remediation work.

The active remediation areas within the RAP-Addendum marked ‘remediation area’ do not clearly delineate the nature of remediation proposed outside of sub-areas NA1, NA2 and NA3.

Recommendation:

The proponent should clearly identify the extent of boundary for the northern remediation areas on a map so that the EPA can consider the suitability and extent of the proposed remediation.

⁴ Section 5.1 Kendall Bay RAP Addendum prepared by Ian Swane and Associates dated 22 June 2018

⁵ EPA correspondence to Jemena Limited, dated 4 April 2017 and 2 August 2017.

⁶ Declaration of Remediation Site (Ref. 21055) issued under section 21 of the *Contaminated Land Management Act 1997*

⁷ See Figure 2a/2b, *Kendall Bay RAP Addendum* prepared by Ian Swane and Associates, dated 22 June 2018

Outcomes of the Kendall Bay Remediation Field Trial

5. In August 2017, the EPA approved the Voluntary Management Proposal (“VMP”) for the finalisation and subsequent implementation of the proposal to mitigate the risks to human health and the natural environment.

As part of the approved RAP, in-situ cement-stabilisation (“ISS”) is proposed in areas where contaminated sediment requires remediation to protect human or ecological health (SA1, NA2+NA3). As required by the VMP, a field trial of proposed remediation method has been conducted.

The RAP identifies that the results of the field trial and the detailed design of other remediation elements will be documented in a Remediation Works Plan (“RWP”)

Recommendation

For the EPA to be confident that ISS is an appropriate method for use in the project, the proponent must provide formal Interim Audit Advice (“IAA”) issued through a Site Auditor accredited under the NSW Site Auditor Scheme that advises on the findings and recommendations resulting from the field trial.

The formal IAA must present the results of the trial consistent with the requirements of the VMP. It is expected that results from the field trials clearly demonstrate that the stabilised product can meet the following performance criteria:

- a) unconfined compressive strength of cement stabilised columns and rafts of >1 MPa
- b) a hydraulic conductivity of less than or equal to 10⁻⁵ cm/s
- c) leachate reduction of 90% from pre-existing state based on Leachate Environmental Assessment Framework (“LEAF”) testing for the contaminants listed in the declaration.

The IAA must also include:

- acknowledgement that the bathymetry of the bay has reached pre-existing levels;
- the application rate of the reagents (lower bound and upper bound limits of rate/mass) proposed for use in in-situ solidification methodology; and
- figures that demonstrate the curing rate of solidified product over time

Validation, Sampling Analysis and Quality Plan

6. The EIS provides that successful completion of the remediation works will be demonstrated by the outcomes of monitoring under the Validation Sampling Analysis and Quality Plan (“VSAQP”).

Recommendation/Requirement

If the EPA issues GTA's for the project in the future, it will require the VSAQP to be prepared by an independent and suitably qualified and experienced Validation Consultant and implemented with assistance from the remediation contractor following guidance provided in the RAP.

The EPA will also require that the VSAQP to be provided for independent review by the Site Auditor and provided to the EPA prior to the commencement of the works to ensure that the success of the remedial work or otherwise can be objectively verified.

Long Term Environmental Management Plan

7. The CSIRO (2016) proposed that the remediation criteria include a 500mm thick cap to prevent physical disturbance or contact by benthic organisms. The RAP - Addendum proposes a 300mm thick cap. The underlying assumption in the reduction of the remediation criteria is that there are '*no known or reasonably foreseeable changes to the current use of the waterway within the declared area*'⁸. The RAP describes how a Site Management Plan ("**SMP**") will be implemented to provide ongoing monitoring and management of the remediation areas. The RAP-Addendum however notes that the SMP is not required.

Recommendation:

The EPA requires a SMP or Long-Term Environment Management Plan ("**LTEMP**") to oversee any potential physical disturbances of the cap noting that the Site Auditor has recommended that contingency plans are required to reassess the risk to human health and environment if the mangroves are removed by anthropogenic or natural causes in the future.

Where the thickness of the cap is less than the CSIRO proposed environmental remediation criteria of 500mm, the SMP or LTEMP must include a section that describes and addresses how any physical disturbances of the cap will be rectified and repaired.

Acid Sulfate Management Plan

8. The RAP acknowledges that there is potential for severe environmental risk if bottom sediments are disturbed by activities such as excavation.

Required information

To demonstrate that the remediation can be undertaken without the generation of acidic leachate, prior to the commencement of works, the EPA will require an Acid Sulfate Soil Management Plan that includes assessment of the:

- solidified, stabilised structure
- untreated sediment to be removed as part of the program of works.

Waste Management

9. The EIS identifies that waste materials may be stored at the Staging Site for transfer to an approved facility. It is not clear where within the Staging Site the waste material will be stored, or what capacity the Staging Site has for accepting and storing material.

Required information

The proponent must clarify the capacity of the Staging Site for storing waste material. In the event that there are delays in obtaining analytical results associated with, (but not limited to) waste classification, the proponent must describe what freeboard has been allowed for in

⁸ SAR, page 34

the storage of waste at the Staging Site. The proponent must describe the potential for the waste product to generate odour and what controls are available to mitigate odour at the Staging Site.

Water Management – Northern Area

10. The EPA notes inconsistencies between the Environmental Impact Statement (“**EIS**”) and associated report titled “Soil and Water Assessment, prepared by Royal Haskoning DHV, dated May 2018 (“**SWA**”).

The SWA proposes to enclose remediation areas NA2 and NA3 in a continuous sheet pile wall which is inconsistent with the outcomes sought within the EIS.

The EIS identified Moon Pools as an alternative primary control for NA2 and NA3. The EPA has identified the potential for dissolved contaminants and sediment attached pollutants to be mobilised out under the bottom of the Moon Pool.

The EPA will require the proponent to address the short-term risks of dissolved contaminants and bio-accumulative pollutants in the design of the primary control noting that three layers of protection must be installed for each marine based remediation area: i.e. a primary control (such as sheet pile walls), a secondary silt curtain and an outer oil boom.

Required information

- a) If the proponent is considering an alternate primary control that is not solid for the full depth of the water column, then detailed water quality monitoring results must be provided to the EPA to demonstrate an equivalent level of environmental protection. The detailed water quality monitoring results must include:
- the potential for dissolved pollutants to cause non-trivial harm to the environment during the remediation;
 - the potential for dispersing bio-accumulative pollutants to be mobilised outside the immediate remediation footprint;
 - discussion and analysis around whether increased dissolved contaminant monitoring would be required and would adequately manage potential environmental risks; and
 - analysis of risks associated with the mobilisation of pollutants in the water column if the primary control was relocated eg: Moon Pools re-located after ISS process.
- b) If sheet piling is the nominated primary control in NA2 and NA3, and SA1, the proponent must consider sealing joints between piling sheets to minimise dissolved contaminants migrating from the immediate work areas.

Water Management – Silt Curtains

11. Recommendation

It is recommended that any vessel movements in and out of silt curtains are supported by standard operating procedures to ensure turbidity levels return to background levels before the silt curtains are opened.

Water Management – Concrete batching

12. It is understood that additives such as fly ash and blast furnace slags will be used within the ISS process. Fly ash and blast furnace slags are not inert materials and while there may be a low potential to cause environmental impact if used, there is potential that they may leach within the water column prior to cement setting.

Recommendation

- a) The proposed Water Quality Management Program or other suitable plan must set out procedures to:
- address the risk of pipe breakage between the barges where concrete mixtures are proposed to be transported;
 - identify any pipe leak detection systems;
 - describe any emergency management processes, including, not limited to spill response or product runoff from the concrete batch barge; and
 - describe the handling, mixing and monitoring procedures that minimise the possibility for water to become toxic prior to cement setting.

Proposed Water Quality Criteria

13. The **SWA** indicates that in the background ambient water sampled, the concentrations of toxicants are generally very low with most samples collected reporting concentrations below the laboratory limit of reporting. However, the EPA notes a number of isolated instances where elevated concentrations were detected for arsenic, copper, zinc, cyanide and PAHs. These elevated results were not confined to any particular monitoring location.

These results also indicate that elevated levels of PAHs are associated with sediments indicating that mobilisation of bed sediments into the water column can result in elevated PAH concentrations within Kendall Bay.

The SWA (Section 7.4.1, Table 1) sets out the proposed water quality trigger values that are proposed be adopted to assess water quality conditions for the remediation project.

These values are based on discharge limits for point source discharges at other sites in Sydney Harbour and are considered to be comparable for process water discharges for this project.

The EPA note that the proposed water quality trigger values for ambient water quality conditions (outside of silt curtains) do not provide an appropriate basis for ALL management actions.

Once the EPA has reviewed the trial remediation report, any proposed recommendations may be subject to amendment.

Recommendation/Requirement

- a) It is recommended that monthly water sampling at each monitoring location (three near-field, two background) should be undertaken during active remediation activities for the following key parameters:
- i. Total suspended solids and turbidity;

- ii. Oil and grease;
 - iii. Dissolved metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn);
 - iv. Total cyanide;
 - v. Total residual hydrocarbons
 - vi. Benzene, toluene, ethylbenzene and xylene;
 - vii. Polycyclic aromatic hydrocarbons;
 - viii. Any potential release of toxicants associated with the cementing process including fly ash, slag, flowing agents, binder or chemical fixation reagents that may cause a non-trivial risk to human health or the environment.
- b) During the first month of commencing any new marine remediation activity, the EPA will require weekly samples to be obtained during active remediation works including cementing works.
- c) The proposed water quality trigger values (SWA section 7.4.1, Table 1) must be updated and amended to develop action-based triggers for the near-field site.

For example, at a red alert level, a significant exceedance of background toxicant levels would trigger:

- a stop to the works
- EPA notification
- revision of the remediation method.

The EPA will require the proponent to prepare an additional set of toxicant values for the amber alert level that consists of a review of water quality management controls.

- d) The proponent must provide further information on the chemicals proposed to be used as ISS additives to demonstrate that those chemicals have no demonstrable impact on water quality.

Water Management – Turbidity

14. The EIS states that a preliminary site-specific turbidity limit, as reported by the SWA, is equivalent to 150 mg/L suspended solids (50 NTU (Nephelometric Turbidity Units)).

This comparison is not consistent with the SWA where:

- the turbidity value equivalent to 50 mg/L TSS is approximately 25 NTU.⁹
- the turbidity value equivalent to 50 mg/L suspended solids is 48 NTU.¹⁰

Recommendation/Requirement

- a) The EPA will require the proponent to adopt a turbidity value equivalent to 50 mg/L suspended solids (50 NTU) until any TSS-turbidity relationship is developed based on sedimentation tests undertaken. Any TSS-turbidity relationship that is identified must be completed in accordance with the recommendations outlined in the US Army Corps of Engineers guidelines: *“Improved Methods for Correlating Turbidity and Suspended Solids for Monitoring”* (Thackston and Palermo, 2000).

⁹ GBA (2007) based on the data investigating vessel movement

¹⁰ SWP (Section 7.6.4) “Turbidity criterion” a preliminary site-specific turbidity limit has been developed based on analysis of field TSS and turbidity data collected during the baseline monitoring period.

- b) The proponent is required to conduct continuous turbidity monitoring at 15-minute intervals. Any results associated with the turbidity monitoring must be linked to an alert system and trigger-action-response framework as set out in the SWA. Nearfield continuous turbidity monitoring locations must be within 5 metres of the secondary silt curtain(s). In addition, the proponent will be required to:
- conduct visual inspections for turbidity and oily sheens as set out in the SWA;
 - undertake reactive water sampling in accordance with the procedure detailed within the SWA; and
 - develop a procedures for wet weather, high wind and stormwater runoff and other factors not associated with the remediation that may increase turbidity should be factored into turbidity triggers.

Waste Water Management

15. The current proposal describes the collection and disposal of untreated waste water to a licenced offsite facility. Waste water will be collected from the free waters pumped off the barges and potentially contaminated water from the Staging Site holding area.

The EIS also indicates that the waste water may be discharged to the Parramatta River.

Recommendation

If the proponent intends to discharge collected waste water or process water to the Parramatta River, an appropriate impact assessment must be provided to the EPA for review.

Air Quality – Odour Management

16. The Air Quality Impact Assessment (AQIA) for the proposal (TAS, 2018) includes dispersion modelling utilising CALPUFF to predict potential impacts of air toxics (benzene, ethylbenzene, xylenes), individual odorous compounds (toluene) and odour (as a complex mixture).

The EPA recognises that there is inherent uncertainty with estimating emissions to air specifically when estimations are based on mean sediment concentrations. The assessment advises that pollutants including metals and PAHs have a low potential to be emitted given their vapour pressure.

However, given the uncertainty associated with quantitative assessment of these activities, the guiding principle for minimising emissions of air toxics is to adopt robust best practice management measures. One of the proposed mitigation measures is to limit the remediation works to daytime hours.

Recommendation

The EPA request that the proponent clarify the hours of operation upon which the Air Quality Impact Assessment has been based.

ATTACHMENT B – Documents Reviewed

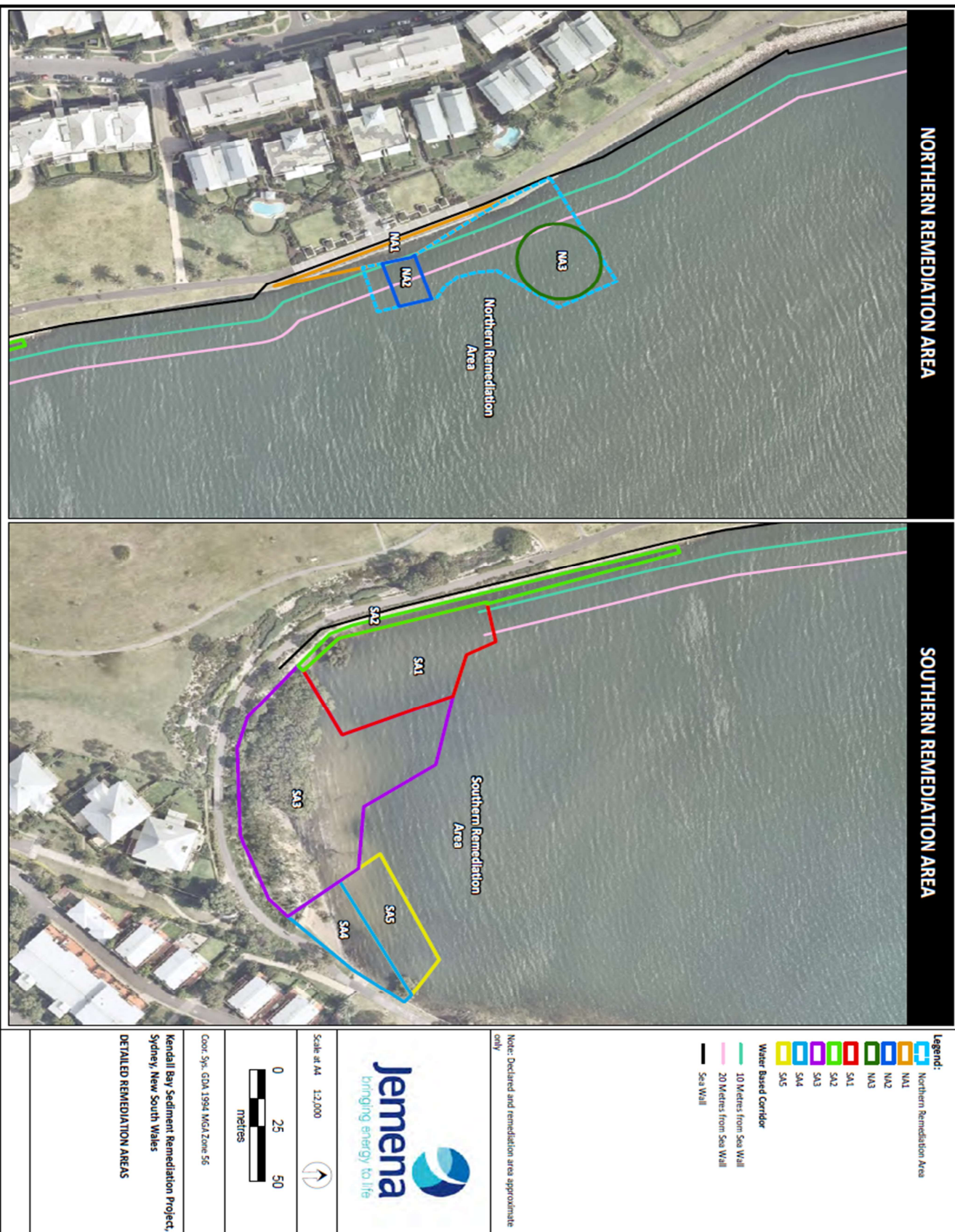
Jemena Kendall Bay EIS_ Main Volume Rev 002 (September, 2018)
Remediation Action Plan, June 2018
Remediation Action Plan, Addendum, June 2018
Stakeholder Management Plan, dated June 2018
Air Quality, dated June 2018
Noise Impact Assessment, dated May 2018
Hydrological Assessment, dated May 2018
Soil and Water Assessment, dated May 2018
Emergency Management Plan.pdf (1.335 MB)
Secretary's Environmental Assessment Requirements, March 2017
Submission of Environmental Impact Statement, dated 21 September 2018
Breakfast Point Community Association, Sediment Remediation Project – Breakfast Owners
Consent, dated 26 June 2018
Political Donations Disclosure Statement
Transport, Roads & Maritime Services, "Remediation work proposed in "Southern Remediation
Area" and "Northern Remediation Area" within Kendall Bay, dated September 2018.

Documents Not Reviewed

Human Health Risk Assessment, dated July 2018
Ecological Risk Assessment, dated March 2018

Biodiversity Data
Marine Benthic Infauna Assemblages Study
Statement of Heritage Impact
Landscape and Visual Impact Assessment
Traffic Impact Assessment, dated May 2018
Navigation Study, dated May 2018
Capital Investment Report, dated June 2018

Document Path: V:\05 Project\Yemen\15464-Iemna-Kendall Bay ES Finalisation\MCOS\Maps\Barrmedation Project Area.mxd
Image Reference: www.nearmap.com © - Imagery Date: 6 May 2017 & ENVI



Attachment C – Batching Cement MSDS

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

1.1 Product identifier

Product name BLENDED CEMENT

Synonym(s) BLUE CIRCLE BUILDERS CEMENT • BLUE CIRCLE SPECIAL PURPOSE CEMENT • BUILDERS CEMENT • FLY ASH BLEND • GB CEMENT • GENERAL BLEND • GENERAL PURPOSE BLENDED CEMENT • LOW HEAT CEMENT • MARINE CEMENT • POZZOMENT • SLAGMENT • SPECIAL PURPOSE CEMENT • SULFATE RESISTING CEMENT • TYPE GB • TYPE LH • TYPE SR • TRIPLE BLEND • SLAG BLEND • GP SLAG BLEND • FA BLEND

1.2 Uses and uses advised against

Use(s) BINDER - REFRACTORIES • CONCRETE • CONSTRUCTION • GROUT • INDUSTRIAL APPLICATIONS • MANUFACTURE OF CEMENTS • MASONRY • MORTAR • SOIL STABILISATION

1.3 Details of the supplier of the product

Supplier name BORAL CONSTRUCTION MATERIALS LTD.

Address Level 3, 40 Mount Street, Nth Sydney, NSW, 2060, AUSTRALIA

Telephone (02) 9220 6300

Email sds@rmt.com.au

Website <http://www.boral.com.au>

1.4 Emergency telephone number(s)

Emergency 1800 555 477 (8am – 5pm WST)

Emergency (A/H) 13 11 26 (Poisons Information Centre)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

CLASSIFIED AS HAZARDOUS ACCORDING TO SAFE WORK AUSTRALIA CRITERIA

GHS classification(s) Skin Corrosion/Irritation: Category 2
Serious Eye Damage / Eye Irritation: Category 2A
Specific Target Organ Systemic Toxicity (Repeated Exposure): Category 2
Specific Target Organ Systemic Toxicity (Single Exposure): Category 3

2.2 Label elements

Signal word WARNING

Pictogram(s)



Hazard statement(s)

H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H373 May cause damage to organs through prolonged or repeated exposure.

Prevention statement(s)

P260 Do not breathe dust/fume/gas/mist/vapours/spray.
P264 Wash thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

PRODUCT NAME BLENDED CEMENT**Response statement(s)**

P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P314 Get medical advice/attention if you feel unwell.
P321 Specific treatment is advised - see first aid instructions.
P362 Take off contaminated clothing and wash before re-use.

Storage statement(s)

P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.

Disposal statement(s)

P501 Dispose of contents/container in accordance with relevant regulations.

2.3 Other hazards

No information provided.

3. COMPOSITION/ INFORMATION ON INGREDIENTS

3.1 Substances / Mixtures

Ingredient	CAS Number	EC Number	Content
QUARTZ (CRYSTALLINE SILICA)	14808-60-7	238-878-4	<5%
CALCIUM OXIDE	1305-78-8	215-138-9	<3%
HEXAVALENT CHROMIUM	18540-29-9	-	<0.002%
PORTLAND CEMENT	65997-15-1	266-043-4	20 to 90%
GROUND BLAST FURNACE SLAG	65996-69-2	-	<80%
FLY ASH	68131-74-8	268-627-4	<40%
LIMESTONE (CALCIUM CARBONATE)	1317-65-3	215-279-6	<7.5%
GYPSUM	13397-24-5	603-783-2	<5%
MAGNESIUM OXIDE	1309-48-4	215-171-9	<3%

Ingredient Notes 1. Depending upon the source material, may contain varying amounts of respirable quartz (crystalline silica).
2. Chromium VI is a trace impurity in Portland Cement (< 20 ppm).

4. FIRST AID MEASURES

4.1 Description of first aid measures

Eye If in eyes, hold eyelids apart and flush continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre, a doctor, or for at least 15 minutes.

Inhalation If inhaled, remove from contaminated area. Apply artificial respiration if not breathing.

Skin If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. Continue flushing with water until advised to stop by a Poisons Information Centre or a doctor.

Ingestion For advice, contact a Poison Information Centre on 13 11 26 (Australia Wide) or a doctor (at once). If swallowed, do not induce vomiting.

First aid facilities Eye wash facilities and safety shower should be available.

4.2 Most important symptoms and effects, both acute and delayed

Irritating to the eyes, skin and respiratory system. Chronic over exposure to silica quartz dust may result in silicosis (lung disease). Principal symptoms of silicosis are coughing and breathlessness. Some individuals may exhibit an allergic response upon exposure to this product, possibly due to the trace amounts of chromium present. Crystalline silica and hexavalent chromium compounds are classified as carcinogenic to humans (IARC Group 1).

4.3 Immediate medical attention and special treatment needed

Treat as for moderate to strong alkali and symptomatically.

5. FIRE FIGHTING MEASURES

5.1 Extinguishing media

Use an extinguishing agent suitable for the surrounding fire.

5.2 Special hazards arising from the substance or mixture

Non flammable. May evolve toxic gases if strongly heated.

5.3 Advice for firefighters

No fire or explosion hazard exists.

5.4 Hazchem code

None allocated.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear Personal Protective Equipment (PPE) as detailed in section 8 of the SDS. Clear area of all unprotected personnel. Contact emergency services where appropriate.

6.2 Environmental precautions

Prevent product from entering drains and waterways.

6.3 Methods of cleaning up

Contain spillage, then collect and place in suitable containers for reuse or disposal. Avoid generating dust.

6.4 Reference to other sections

See Sections 8 and 13 for exposure controls and disposal.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Before use carefully read the product label. Use of safe work practices are recommended to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating. Prohibit eating, drinking and smoking in contaminated areas.

7.2 Conditions for safe storage, including any incompatibilities

Store in a cool, dry, well ventilated area, removed from moisture, incompatible substances and foodstuffs. Ensure packages are adequately labelled, protected from physical damage and sealed when not in use.

7.3 Specific end use(s)

No information provided.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

Exposure standards

Ingredient	Reference	TWA		STEL	
		ppm	mg/m ³	ppm	mg/m ³
Calcium carbonate (Limestone, Marble, Whiting)	SWA (AUS)	--	10	--	--
Calcium oxide	SWA (AUS)	--	2	--	--
Chromium (VI) compounds (as Cr)	SWA (AUS)	--	0.05	--	--
Gypsum (Calcium sulphate)	SWA (AUS)	--	10	--	--
Magnesium oxide (fume)	SWA (AUS)	--	10	--	--
Portland Cement	SWA (AUS)	--	10	--	--
Quartz (respirable dust)	SWA (AUS)	--	0.1	--	--

Biological limits

No biological limit values have been entered for this product.

8.2 Exposure controls

Engineering controls Avoid inhalation. Use in well ventilated areas. Where an inhalation risk exists, mechanical extraction ventilation is recommended. Maintain dust levels below the recommended exposure standard.

PPE

Eye / Face	Wear safety glasses or dust-proof goggles when handling material to avoid contact with eyes.
Hands	Wear PVC, rubber or cotton gloves when handling material to prevent skin contact.
Body	Wear long sleeved shirt and full-length trousers.
Respiratory	Where an inhalation risk exists wear a Class P1 (Particulate) respirator, dependent on a site specific risk assessment.



9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance	FINE OFF-WHITE TO DARK GREY POWDER
Odour	ODOURLESS
Flammability	NON FLAMMABLE
Flash point	NOT RELEVANT
Boiling point	NOT AVAILABLE
Melting point	> 1200°C
Evaporation rate	NOT AVAILABLE
pH	11 to 13
Vapour density	NOT AVAILABLE
Specific gravity	2.9 - 3.2
Solubility (water)	< 10 g/L
Vapour pressure	NOT AVAILABLE
Upper explosion limit	NOT RELEVANT
Lower explosion limit	NOT RELEVANT
Partition coefficient	NOT AVAILABLE
Autoignition temperature	NOT AVAILABLE
Decomposition temperature	NOT AVAILABLE
Viscosity	NOT AVAILABLE
Explosive properties	NOT AVAILABLE
Oxidising properties	NOT AVAILABLE
Odour threshold	NOT AVAILABLE

9.2 Other information

Density	1100 - 1550 kg/m ³ (Bulk)
% Volatiles	NOT AVAILABLE

10. STABILITY AND REACTIVITY

10.1 Reactivity

Carefully review all information provided in sections 10.2 to 10.6.

10.2 Chemical stability

Stable under recommended conditions of storage.

10.3 Possibility of hazardous reactions

Hazardous polymerization is not expected to occur.

10.4 Conditions to avoid

Avoid heat, sparks, open flames and other ignition sources.

10.5 Incompatible materials

Incompatible with oxidising agents (e.g. hypochlorites), ethanol, acids (e.g. hydrofluoric acid) and interhalogens (e.g. chlorine trifluoride). Water contact may increase product temperature 2°C to 3°C.

10.6 Hazardous decomposition products

May evolve toxic gases if heated to decomposition.

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity	No known toxicity data is available for this product. Based on available data, the classification criteria are not met.
Skin	Irritating to the skin. Contact with powder or wetted form may result in irritation, rash and dermatitis.
Eye	Irritating to the eyes. Contact may result in irritation, lacrimation, pain, redness, corneal burns and possible permanent damage.
Sensitization	This product is not classified as a skin or respiratory sensitiser. However, some individuals may exhibit an allergic response upon exposure to cement, possibly due to trace amounts of chromium.
Mutagenicity	Insufficient data available to classify as a mutagen.
Carcinogenicity	This product contains crystalline silica which is classified as carcinogenic to humans (IARC Group 1). However, there is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis. Therefore, preventing the onset of silicosis will also reduce the cancer risk. Hexavalent chromium compounds are classified as carcinogenic to humans (IARC Group 1), however due to the trace amounts present, the criteria for classification is not met.
Reproductive	Insufficient data available to classify as a reproductive toxin.
STOT – single exposure	Irritating to the respiratory system. Over exposure may result in irritation of the nose and throat, with coughing. High level exposure may result in breathing difficulties.
STOT – repeated exposure	Repeated exposure to respirable silica may result in pulmonary fibrosis (silicosis). Silicosis is a fibronodular lung disease caused deposition in the lungs of fine respirable particles of crystalline silica. Principal symptoms of silicosis are coughing and breathlessness. In the wet state, the likelihood of an inhalation hazard is reduced.
Aspiration	This product is a solid and aspiration hazards are not expected to occur.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

May be harmful to the aquatic environment due to the alkaline nature of the product. This product is non-toxic to aquatic organisms when present as a cured solid.

12.2 Persistence and degradability

Product is persistent and would have a low degradability.

12.3 Bioaccumulative potential

This product is not expected to bioaccumulate.

12.4 Mobility in soil

A low mobility would be expected in a landfill situation.

12.5 Other adverse effects

Avoid contamination of drains and waterways.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Waste disposal	Reuse or recycle where possible. Alternatively, ensure product is covered with moist soil to prevent dust generation and dispose of to an approved landfill site. Contact the manufacturer/supplier for additional information (if required).
Legislation	Dispose of in accordance with relevant local legislation.

14. TRANSPORT INFORMATION**NOT CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE, IMDG OR IATA**

	LAND TRANSPORT (ADG)	SEA TRANSPORT (IMDG / IMO)	AIR TRANSPORT (IATA / ICAO)
14.1 UN Number	None Allocated	None Allocated	None Allocated
14.2 Proper Shipping Name	None Allocated	None Allocated	None Allocated
14.3 Transport hazard class	None Allocated	None Allocated	None Allocated
14.4 Packing Group	None Allocated	None Allocated	None Allocated

14.5 Environmental hazards No information provided**14.6 Special precautions for user**

Hazchem code None Allocated

15. REGULATORY INFORMATION**15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture****Poison schedule** A poison schedule number has not been allocated to this product using the criteria in the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).**Classifications** Safework Australia criteria is based on the Globally Harmonised System (GHS) of Classification and Labelling of Chemicals.

The classifications and phrases listed below are based on the Approved Criteria for Classifying Hazardous Substances [NOHSC: 1008(2004)].

Hazard codes Xi Irritant
Xn Harmful**Risk phrases** R36/37/38 Irritating to eyes, respiratory system and skin.
R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation.**Safety phrases** S22 Do not breathe dust.
S24/25 Avoid contact with skin and eyes.
S36/37 Wear suitable protective clothing and gloves.**Inventory listing(s)** **AUSTRALIA: AICS (Australian Inventory of Chemical Substances)**
All components are listed on AICS, or are exempt.**16. OTHER INFORMATION****Additional information** **PERSONAL PROTECTIVE EQUIPMENT GUIDELINES:**
The recommendation for protective equipment contained within this report is provided as a guide only. Factors such as method of application, working environment, quantity used, product concentration and the availability of engineering controls should be considered before final selection of personal protective equipment is made.**HEALTH EFFECTS FROM EXPOSURE:**
It should be noted that the effects from exposure to this product will depend on several factors including: frequency and duration of use; quantity used; effectiveness of control measures; protective equipment used and method of application. Given that it is impractical to prepare a ChemAlert report which would encompass all possible scenarios, it is anticipated that users will assess the risks and apply control methods where appropriate.

PRODUCT NAME BLENDED CEMENT**Abbreviations**

ACGIH	American Conference of Governmental Industrial Hygienists
CAS #	Chemical Abstract Service number - used to uniquely identify chemical compounds
CNS	Central Nervous System
EC No.	EC No - European Community Number
GHS	Globally Harmonized System
IARC	International Agency for Research on Cancer
LC50	Lethal Concentration, 50% / Median Lethal Concentration
LD50	Lethal Dose, 50% / Median Lethal Dose
mg/m ³	Milligrams per Cubic Metre
OEL	Occupational Exposure Limit
pH	relates to hydrogen ion concentration using a scale of 0 (high acidic) to 14 (highly alkaline).
ppm	Parts Per Million
STEL	Short-Term Exposure Limit
STOT-RE	Specific target organ toxicity (repeated exposure)
STOT-SE	Specific target organ toxicity (single exposure)
SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
SWA	Safe Work Australia
TLV	Threshold Limit Value
TWA	Time Weighted Average

Revision history

Revision	Description
2.0	Converted to GHS
1.0	Initial Release

Report status

This document has been compiled by RMT on behalf of the manufacturer, importer or supplier of the product and serves as their Safety Data Sheet ('SDS').

The information presented herein is based on data considered to be accurate as of the date of preparation of this SDS. However, no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorisation given or implied to practice any patented invention without a licence. In addition, no responsibility can be assumed by the vendor for any damage or injury resulting from abnormal use, without a risk assessment for safe use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the products.

This Safety Data Sheet (SDS) applies only to the formulated material as supplied by Boral Cement. It does not apply where the formulation has been altered. In this case a new SDS may be required to reflect the modified material. Contact Boral Cement for further information.

Printed documents are uncontrolled. Refer to www.boral.com.au regularly for a more recent copy of the SDS where it exists.

Prepared by

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Revision: 2

SDS date: 21 January 2015

[End of SDS]

MasterMatrix UW 440

Anti-wash out admixture for use in underwater concrete or piling applications

DESCRIPTION

MasterMatrix UW 440 anti-washout admixture is a ready to use, powdered admixture specially developed for concrete placed underwater. Concrete treated with MasterMatrix UW 440 exhibits superior resistance to washout of cement and fines.

MasterMatrix UW 440 complies with BS 8443:2005 – “Specification for establishing the suitability of special purpose concrete admixtures” - Table 2 - Underwater Concrete Admixtures.

MasterMatrix UW 440 can also be used, at a lower dosage rate, in piling applications to prevent poor surrounding ground conditions from absorbing moisture from the concrete mix, and therefore making post pouring operations such as placing the reinforcing cage easier.

FIELDS OF APPLICATION

MasterMatrix UW 440 admixture is recommended for use in all types of concrete pumped or placed underwater, where thixotropic action is desired. MasterMatrix UW 440 admixture is especially helpful in extreme conditions where conventional concrete or placing techniques would result in a high percentage of material loss due to washout.

Piling operations in poor ground conditions, or where a deep reinforcing cage needs to be inserted after the completion of the concrete placement.

FEATURES AND BENEFITS

MasterMatrix UW 440 admixture produces a concrete mixture highly resistant to washout, while maintaining workability, pumpability, and placeability. The following special qualities are also provided:

- Minimal to no effect on water demand.
- Reduces or eliminates concrete bleeding.
- Workability characteristics equal to untreated concrete.
- Virtually eliminates segregation even with highly fluid, high water-cementitious ratio mixes.
- Reduces/eliminates costly methods of de-watering.

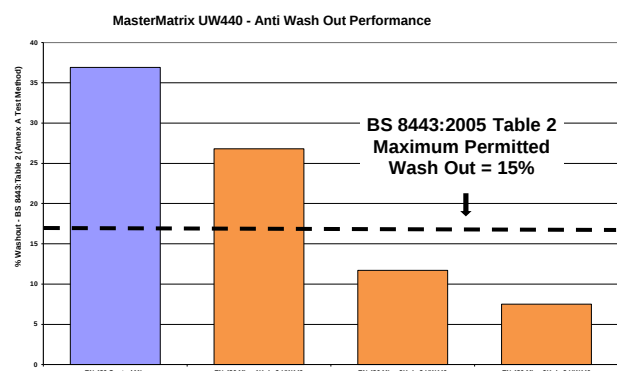
- Thixotropic action provides stiffening after concrete is placed.
- Minimises environmental impact of cement washout in water.
- Minimal to no effect on set time.
- Prevents absorption of moisture from the concrete into surrounding ground during piling operations.
- Easier placement of deep section reinforcing cages.

APPLICATION PROCEDURE

MasterMatrix UW 440 admixture should be used in conjunction with a high range water reducing admixture from the MasterPolyheed, MasterGlenium, MasterEase or MasterSure ranges. This combination will produce a high performance, high strength, low water-cementitious ratio concrete that exhibits superior resistance to washout of cement and fines.

WASHOUT RESISTANCE

Washout as determined by Annex A of BS 8443:2005 “Determination of Washout”, reports the performance of MasterMatrix UW 440 admixture treated concrete compared to untreated concrete. This requires that an anti-washout admixture must result in a washout value of less than 15% when compared to the EN 480 control mix.



WORKABILITY RETENTION

Results from slump loss studies taken over a 60 minute period indicate MasterMatrix UW 440 admixture does not adversely affect concrete workability retention.

MasterMatrix UW 440

Anti-wash out admixture for use in underwater concrete or piling applications

SET TIME

MasterMatrix UW 440 admixture has little to no effect on concrete set time.

AIR CONTENT

A slightly higher dosage of air entraining admixture may be required to achieve the desired air content when using MasterMatrix UW 440 admixture.

COMPRESSIVE STRENGTH

MasterMatrix UW 440 admixture has an effect on compressive strength. It is strongly recommended that trial mixes be carried out to establish the correct performance. Although this effect is lower when using in a piling operation, it is still recommended that trial mixes be performed prior to actual use on site.

DOSAGE

For most underwater concrete mixtures, MasterMatrix UW 440 admixture is recommended for use at a dosage range of:

- *By Mass* - 1.5 to 3.0kg per cubic metre of concrete, typically 2.0kg will give less than 15% washout at a cement content of 450 kg/m³ and a w/c ratio of less than 0.45.

For most piling operations the MasterMatrix UW 440 admixture is recommended for use at a dosage range of:

- *By Mass* - 0.4 to 1.0kg per cubic metre of concrete, in most situations a dosage rate of 0.4 to 0.5 kg/m³ is suitable.

The dosage rates given above are for typical usages, they are not meant as absolute limits, as other dosages may be utilised in special cases according to specific job conditions. If required consult BASF Construction Chemicals Technical Services Department for advice. Trial mixes should be carried out to ensure optimum dosage and effect.

COMPATIBILITY

MasterMatrix UW 440 can be used with all types of EN 197 Cements. For use with other special cements, contact our Technical Services Department.

MasterMatrix UW 440 should not be pre-mixed with other admixtures. If other admixtures are to be used in concrete containing the MasterPolyheed range they must be dispensed separately.

When complimentary admixtures are required it is important that trials are performed, prior to any supply, to determine the respective dosages of any complimentary admixture, and the suitability, in the fresh and hardened state, of the resultant concrete. In these circumstances we recommend that you consult our Technical Services Department for further advice.

PACKAGING

MasterMatrix UW 440 is available in 1.0kg water soluble sachets, with 12 sachets in each plastic tub.

CONTACT DETAILS

BASF plc,
Construction Chemicals,
P.O. Box 4,
Earl Road,
Cheadle,
Cheshire, SK8 6QG
Tel: +44 (0) 161 488 5264
Fax +44 (0) 161 488 5220
www.master-builders-solutions.basf.co.uk

MasterMatrix UW 440

Anti-wash out admixture for use in underwater concrete or piling applications

Product Data	
Appearance	Beige Powder
Uncompacted Bulk Density @ 20°C	560 kg/m ³
Chloride content (%)	Less than or equal to 0.10
Logistics	
Shelf life:	18 months if stored according to manufacturer's instructions in unopened container.
Storage conditions:	Store in original sealed containers and at temperatures between 5°C and 30°C. Store under cover, out of direct sunlight and protect from extremes of temperature. Failure to comply with the recommended storage conditions may result in premature deterioration of the product or packaging.
Handling and transportation:	Refer to MasterMatrix UW 440 Safety Data Sheet
Disposal:	Refer to MasterMatrix UW 440 Safety Data Sheet

MasterMatrix UW 440, BASF plc, Construction Chemicals, Version 6

Health and Safety

*For full information on Health and Safety matters regarding this product the relevant Health and Safety Data Sheet should be consulted.

The following general comments apply to all products.

As with all chemical products, care should be taken during use and storage to avoid contact with eyes, mouth, skin and foodstuffs, (which may also be tainted with vapour until the product is fully cured and dried). Treat splashes to eyes and skin immediately. If accidentally ingested, seek medical attention. Keep away from children and animals. Reseal containers after use.

Spillage

Chemical products can cause damage; clean spillage immediately.

DISCLAIMER

"BASF plc, Construction Chemicals" (the Company) endeavours to ensure that advice and information given in Product Data Sheets, Method Statements and Material Safety Data Sheets (all known as Product Literature) is accurate and correct. However, the Company has no control over the selection of its products for particular applications. It is important that any prospective customer, user or specifier, satisfies him/her-self that the product is suitable for the specific application. In this process, due regard should be taken of the nature and composition of the background/base and the ambient conditions both at the time of laying/applying/installing the material and when the completed work is to be brought into use.

Accordingly, no liability will be accepted by the Company for the selection, by others, of a product, which is inappropriate to a particular application.

Products are sold subject to the Company's standard conditions of sale and all customers, users and specifiers, should ensure that they examine the Company's latest Product Literature.



Hazardous Chemical in accordance with the WHS
Hazardous Substance in accordance with NOSHC
 Not a Dangerous Good according to the ADG Code.

IDENTIFICATION

Product Name	Sodium Silicate Solution, MR 2.6-3.2
Other Names	Silicic Acid, Sodium Salt Solution; Water Glass; Soluble Glass. N-Grade, O-Grade, JHG-Grades, NG-Grade

Trade Names:
As Defined

Manufacturer:
PQ AUSTRALIA PTY LTD

USE

May be used as a: detergent ingredient; adhesive; binder; feedstock silica source; general chemical.

COMPANY DETAILS

Company Name	PQ Australia Pty Ltd	A.C.N. No. 005 399 100
Address	HEAD OFFICE: 9-13 Rhur Street PO Box 4380 Dandenong South VICTORIA 3164 Tel: (03) 9708 9200 Fax: (03) 9708 9250	N.S.W. Branch 8-10 Riverside Road Chipping Norton New South Wales 2170 Tel: (03) 9708 9200

Emergency Telephone No: 1800 240 779



Section 2. HAZARDS IDENTIFICATION

Signal Word

WARNING

Dangerous Goods Information:

Not a Dangerous Good according to the ADG Code.

Hazardous Chemical Information:

Hazardous Chemical according to WHS

Hazardous Substance Information

Hazardous Substance according to NOSHC

Poison Schedule

Scheduled Poison S5

Emergency Overview

Alkaline; may be harmful by ingestion and contact with skin and eyes

Acute Health Effects

Swallowed	Swallowing can result in nausea, vomiting, abdominal pain and diarrhoea. May cause severe irritation to the mouth, throat and stomach.
Eye	A severe eye irritant. May cause conjunctivitis (inflammation of the eyes) and possibly corneal burns and ulceration.
Skin	Irritating to skin. May cause itching and skin rash.
Inhaled	Exposure to vapours at room temperature is an unlikely route of exposure due to its low vapour pressure. Spray mist will cause respiratory irritation and may result in coughing as well as inflammation of nose, throat and windpipe.

Chronic Health Effects

All Routes	Prolonged or repeated skin contact may cause dry skin. Defatting of the skin can result in irritation and dermatitis (inflammation of the skin).
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Hazardous Classes and Categories

Physical	Not applicable	
Health:	Acute toxicity (oral)	Category 5 – May be harmful if swallowed
	Acute toxicity (inhalation)	Not applicable
	Contact Hazard (eye)	Category 2A – Causes serious eye irritation
	Contact hazard (skin)	Category 2 – Causes skin irritation
	Carcinogenicity	Not classified by NOHSC, OSHA, IARC
Environmental	Not applicable	



Labelling Elements

Signal Word: **WARNING**

Hazard Statements: H303 May be harmful if swallowed
H315 Causes skin irritation
H319 Causes serious eye irritation

Precautionary Statements

Prevention P264 Wash thoroughly after handling
P270 Do not eat, drink or smoke when using this product
P280 Wear protective gloves/clothing/eye protection/face protection

Response P301 + P312 IF SWALLOWED: Call a poison center or doctor if you feel unwell
P303/ P361/P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P305/P351/P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do so. Continue rinsing.
P332 + P313 If skin irritation occurs get medical advice/attention

Storage P405 Store locked up

General P101 If medical advice is needed have product container or label at hand
P102 Keep out of reach of children
P103 Read label before use



Pictogram:

Pictogram Description: Exclamation Mark

Section 3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Identity of Ingredients	CAS No.	EINECS No	Proportion
Sodium Silicate	1344-09-8	2156874	30-60 %
Water	7732-18-5	2317912	30-60 %

Section 4. FIRST AID MEASURES

Scheduled Poisons	Poisons Information Centre in each Australian State capital city can provide additional assistance for scheduled poisons. (Telephone Australia 13 1126) or a doctor immediately
First Aid Facilities	Safety shower and eye wash facilities should be easily accessible in the immediate area
Swallowed	Immediately rinse mouth with water. Repeat until product is thoroughly removed. Give water to drink. DO NOT induce vomiting due to risk of further damage. If vomiting occurs give water to drink to further dilute the product. Seek medical attention. Contact the Poisons Information Centre (available in each State capital city).
Eye	Hold eyelids apart and flush the eyes continuously with running water. Continue flushing until advised to stop by the Poisons Information Centre or a doctor for at least 15 minutes. If irritation develops seek medical attention.
Skin	Immediately wash contaminated skin with plenty of water. Soaked clothing should be removed while under the safety shower and skin washed with running water for a minimum of 30 minutes. No attempt should be made to neutralize the alkali with acid solutions, as this could aggravate the burns. Seek medical attention if health effects develop or persist.
Inhaled	Not expected to be an inhalation hazard under normal use. Remove victim to fresh air. Seek medical attention if health effects develop or persist.
Advice to Doctor	Treat symptomatically as for strong alkalis.

Section 5 - FIRE FIGHTING MEASURES

Fire or Explosion Hazard:	Aqueous solution, not flammable under normal conditions of use. Flammable hydrogen gas may be produced on prolonged contact with metals such as aluminium, tin, lead, and zinc.
Extinguishing Media	Compatible with dry chemical water spray, regular foam and carbon dioxide fire extinguishing media. No media identified as unsuitable.
Specific Combustion Hazards	Product is non combustible. Flammable hydrogen gas may be produced on prolonged contact with metals such as aluminium, tin, lead, and zinc.
Special Protective Precautions & Equipment	Chemical goggles, body-covering protective clothing, chemical resistant gloves, and rubber boots.
Flash Point	Not applicable
Flammability	Product is non flammable according to the Australian Code for Transport of Dangerous Goods.



Section 6 - ACCIDENTAL RELEASE MEASURES

Personal Precautions	Avoid contact with skin and eyes and avoid breathing any fumes formed. Dries to form glass film which can easily cut skin. Spilled liquids are very slippery. Wear appropriate personal protective equipment as recommended in Section 8
Methods for Containment and Cleaning Up	Small spill cleanup: Prevent runoff from entering into storm sewers and ditches which lead to natural waterways. Isolate, dike and store discharged material, if possible. Use sand or earth to contain spilled material. Shovel dried waste into suitable container and dispose of in accordance with Section 13. Large spill cleanup: Keep unnecessary people away; isolate hazard area and deny entry. Do not touch or walk through spilled material. Stop leak if you can do so without risk. Prevent runoff from entering into storm sewers and ditches which lead to natural waterways. Isolate, dike and store discharged material using sand or earth. Spilled liquid may be collected using a vacuum truck. If containment is impossible, neutralize contaminated area and flush with large quantities of water. Cover remaining liquid with sand or earth and shovel dried material into suitable container. Dispose of any material collected in accordance with Section 13.
Environmental Precautions	Sinks and mixes with water. Liquid is alkaline and may increase the pH. High pH can be harmful to aquatic life. Avoid release into water systems and sewers.

Section 7 - HANDLING and STORAGE

Safe Handling	Avoid contact with eyes, skin and clothing. Avoid breathing spray mist. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Take appropriate precautions when handling bulk product that is transported/shipped whilst hot as it can cause thermal burns. Wear appropriate personal protective equipment as recommended in Section 8. Keep containers closed. Promptly clean residue from closures with cloth.
Safe Storage	Store in accordance with all local regulations and codes of practice. Ensure containers are labelled and kept closed when not in. Storage temperature 0-90° C. Loading temperature 10-70 ° C. Mild steel is the most suitable material of construction for drums, tanks, valves, pipe-work, etc. Concrete storage tanks can be used but must be strong enough to hold the weight of Sodium Silicate solution to be stored and thick enough to prevent seepage of water.
Incompatibilities/ Materials to Avoid	Do not store in aluminum, fiberglass, copper, brass, zinc or galvanized containers. Store away from acids and foodstuffs. Store in clean steel or plastic containers. Separate from acids, reactive metals, and ammonium salts.



Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

National Exposure Standards	No exposure standards have been established for the ingredients in this product by Workplace Exposure Standards as published by Safe Work Australia An exposure limit of $2\text{mg}/\text{m}^3$ (15min TQA) is recommended by analogy with sodium hydroxide This standard is the manufacturers recommended limit for good practice. All atmospheric contamination should be minimized.
Design and Engineering Control Measures	Use in well ventilated area. Avoid generating and inhaling mists. Ensure exposure is managed within recommended exposure limits.
Environmental Controls	Ensure material is used in an appropriately bunded area to prevent release into soil, water systems and sewers.
Personal Protective Equipment	Avoid skin and eye contact. Avoid inhaling the vapour or mist. Follow normal industrial safety practices. The use of protective clothing and equipment depends on the degree and nature of exposure. The following personal protective equipment should be used:
Eye/Face	Wear glasses with side shields. If contact with material is likely the use of chemical resistant goggles in combination with a full face shield is recommended. Ensure a suitable eyewash station is within the immediate vicinity.
Skin/Body	Wear chemical resistant overalls, a full apron or similar protective clothing. Wear appropriate chemical resistant protective boots.
Hand	Wear chemical resistant gloves. If contact is likely wear the use of full arm length gauntlets is recommended. Dried silicate can present physical hazards including cuts and abrasions. Wear cut resistant gloves if handling dried silicate.
Respiratory	Respiratory protection is not normally required due to low inhalation risk. If material is likely to be vaporized the use an approved respirator is necessary. Consult a respiratory equipment supplier to aid selection of the appropriate type. Wash contaminated clothing and protective equipment before storing and re-using. The use of barrier cream is recommended. Refer to Section 15 in relation to the Australian Standards for PPE

Section 9 - PHYSICAL and CHEMICAL PROPERTIES

Appearance and Odour	Clear to hazy, colorless, odorless, thick liquid.
Chemical Formula	$x\text{SiO}_2/\text{Na}_2\text{O}$ (<i>x ranges from 2.0–3.3</i>)
Melting Point / Boiling Point	MP: 0°C approx. BP: 105 to 108°C
Decomposition Temperature	Water Boils off at 102°C to 108°C



Vapour Pressure	Not determined
Relative Vapour Density	Not applicable
Specific Gravity or Density	1.2 to 1.6 (<i>typical range</i>)
Solubility	Soluble in water.
pH	11 to 13 (of the concentrate)
Viscosity	20 – 5000cps
Percent Volatile	30-60%
VOC Content	0%
Octanol/Water Partition Co-efficient	log P(octanol/water) – Not available
Corrosiveness	Some corrosive effects on Aluminium, Copper, Tin, Zinc, Lead etc
Flammable Properties	Non combustible liquid. The aqueous solution is not flammable under normal conditions of use. Flammable hydrogen gas may be produced on prolonged contact with metals such as aluminium, tin, lead, and zinc.
Flashpoint	Not applicable to aqueous solutions
Flammability Limits (FL) (%)	Not applicable to aqueous solutions
Autoignition Temp	Not applicable to aqueous solutions

Section 10 - STABILITY AND REACTIVITY

Chemical Stability	Stable in sealed containers. Absorbs Carbon Dioxide on exposure to air, which results in the deposition of Insoluble Silica.
Conditions To Avoid:	Leaving solutions exposed to carbon dioxide in the air. Prolonged storage above 50°C or below 10°C
Incompatible Materials:	Will react exothermically with acids.
Unsuitable Container Materials:	Sodium Silicate solutions are strongly alkaline and are not compatible with aluminium, copper, brass, bronze, zinc, tin and lead. Can etch glass if not promptly removed.
Hazardous Decomposition Products:	If Overheated: The solution will boil and irritating Sodium Silicate containing mists will be released.
Hazardous Reactions:	Flammable hydrogen gas will form on reaction with aluminium, copper, zinc etc. Gels and generates heat when mixed with acid. May react with ammonium salts resulting in evolution of ammonia gas.

Section 11 - TOXICOLOGICAL INFORMATION

Toxicity Data:	Acute Oral Toxicity LD50 (rat): 5000 mg/kg (as 100%) The acute oral toxicity of this product has not been tested. When Sodium Silicates were tested on a 100% solids basis, their single dose acute oral LD50 in rats ranged from 1152 mg/kg (above) to 5700 mg/kg. The acute oral lethality resulted from nonspecific causes. These products contain 30-60% Sodium Silicate thus each
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overall product has an Acute Oral Toxicity LD50 (rat): >3000 mg/kg.

Subchronic Data:

In a study of rats fed Sodium Silicate in drinking water for three months, at 200, 600 and 1800 ppm, changes were reported in the blood chemistry of some animals, but no specific changes to the organs of the animals due to Sodium Silicate administration were observed in any of the dosage groups. Another study reported adverse effects to the kidneys of dogs fed Sodium Silicate in their diet at 2.4g/kg/day for 4 weeks, whereas rats fed the same dosage did not develop any treatment-related effects. Decreased numbers of births and survival to weaning was reported for rats fed Sodium Silicate in their drinking water at 600 and 1200 ppm.

Skin Corrosion/Irritation:

When tested for primary skin irritation potential, this material produced irritation with a primary irritation index of 3 to abraded skin and 0 to intact skin. Human experience confirms that irritation occurs when this material gets on clothes at the collar, cuffs or other areas where abrasion may occur.

Sodium silicates can be irritating to corrosive to the skin of rabbits, depending on their molar ratio and concentration. Irrespective of the counterion (Na^+ or K^+), silicates were found to be corrosive at molar ratios up to 1.6 and concentrations >50%. At molar ratios >1.6, silicates are irritating to the skin, while molar ratios >3.2 and concentrations <40% did not lead to irritative effects.

Eye Damage/Irritation:

When tested for primary eye irritation potential according to OECD Guidelines, Section 405, this material produced corneal, iridal and conjunctival irritation. Some eye irritation was still present 14 days after treatment, although the average primary irritation score had declined from 19.7 after 1 day to 4.0 after 14 days.

Respiratory or Skin Sensitization

In a mouse local lymph node assay, sodium metasilicate was not sensitising. In humans, a single case of contact urticaria elicited by sodium silicate is reported.

Mutagenicity

In vitro, soluble silicates did not induce gene mutations in bacteria. Sodium silicate was negative in an E. coli reverse mutation. In a modern guideline study that was performed in accordance with OECD TG 473, an aqueous sodium silicate solution (36% active ingredient, WR 3.3) induced no chromosomal aberrations in Chinese hamster V79 cells. From the available evidence it can be concluded that there is no evidence of a genotoxic potential for soluble silicates.

Carcinogenicity

The information available does not indicate any potential for carcinogenicity. Frequent ingestion over extended periods of time of gram quantities of silicates is associated with the formation kidney stones and other siliceous urinary calculi in humans. Sodium Silicate is not listed by IARC, NTP or OSHA as a carcinogen.

Reproductive Toxicity

In a developmental toxicity study, pregnant mice were administered 12.5, 50 or 200 mg/kg bw/d sodium metasilicate in aqueous solution from day 0 until 17/18 of gestation by daily gavage. Litter size and fertility index were unaffected at concentrations up to and including 200 mg/kg bw/d. Furthermore, no developmental



effects were observed up to and including 200 mg/kg bw/d.

Also, in repeat dose toxicity studies with rats, mice and dogs the macroscopic and microscopic examination of reproductive organs did not reveal treatment-related effects.

In summary, no indications of reproductive effects for silicates have been reported.

Section 12 - ECOLOGICAL INFORMATION

General: Avoid contaminating waterways. Soluble in water.

Sinks and mixes with water. Only water will evaporate from this material.

Ecotoxicity Data: Acute toxicity testing in fish, invertebrates and algae indicate a low order of toxicity: the soluble silicates exhibit aquatic toxicities in excess of 100 mg/l irrespective of molar ratio or metal cation.

Group	Type	Concentration	Molar Ratio	Dose Rate
Fish	Danio rerio	LC50 (96h)	Na, MR 1.0	210mg/l
Fish	Oncorhynchus mykiss	LC50 (96h)	Na, MR 3.1	260-310mg/l
Invertebrate	Daphnia Magna	EC50 (48h)	Na, MR 3.2	1700mg/l
Microorganisms	Pseudomonas putida	EC0 (18h)	Na, MR 3.46	348mg/l
Microorganisms	Pseudomonas putida	EC0 (30min)	Na, MR 1.0	1000mg/l

Persistence & Degradability

This material is not persistent in aquatic systems, but its high pH when undiluted or unneutralized is acutely harmful to aquatic life. Diluted material rapidly depolymerizes to yield dissolved silica in a form that is indistinguishable from natural dissolved silica. It does not contribute to BOD. This material does not bioaccumulate except in species that use silica as a structural material such as diatoms and siliceous sponges.

Neither silica nor sodium will appreciably bioconcentrate up the food chain.

Mobility

Expected to be mobile in soil. Diluted material rapidly depolymerizes to yield dissolved silica in a form that is indistinguishable from natural dissolved silica.

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Methods & Containers

Disposal to be in accordance with Local, State & Federal EPA waste regulations. Normally suitable for disposal at approved land waste site after dilution or neutralisation.

Landfill, Incineration

After dilution or neutralisation may be landfilled.
Not suitable for incineration.

Section 14 - TRANSPORT INFORMATION

ROAD & RAIL:

Not defined as a Dangerous Good: by the Australian Code for the Transport of Dangerous Goods by Road & Rail.

SEA:

Not a Dangerous Good according to the International Maritime Dangerous Goods Code (IMDG Code).

AIR:

Not a Dangerous Good according to the International Air Transport Association



(IATA) Dangerous Goods Regulations.

Section 15 - REGULATORY INFORMATION

Labelling: Workplace Hazardous Substance Labelling

Signal Word: **WARNING**

Scheduled Poison Labelling for S5

The labelling requirements of the SUSDP do not apply to a poison that:

1. is packed and sold solely for dispensary, industrial, laboratory or manufacturing purposes; and
2. is labelled in accordance with the NOHSC *National Code of Practice for the Labelling of Workplace Hazardous Substances* [NOHSC:2012(1994)]

Not a Dangerous Good:

Packaging

Mild steel is the most suitable material of construction for drums, tanks, valves, pipe-work, etc.

Australian Chemical Control Schemes		
NICNAS – AICS		<i>All ingredients listed</i>
Aust. Pesticides & Veterinary Medicine Authority	- Ag & Vet Chemicals	<i>Not applicable</i>
Therapeutic Goods Administration	- SUSMP	<i>Scheduled poison S5</i>
Food Standards Australian & New Zealand	- Food	<i>Not applicable</i>
<i>Chemicals weapons Act</i>		<i>Not applicable</i>
<i>Ozone Depleting Substance Act</i>		<i>Not applicable</i>

Australian Standards

AS/NZS 1337.1:2010	Personal eye protection – Eye and face protectors for occupational applications
AS/NZS1715:2009	Selection use and maintenance of respiratory protective equipment
AS/NZS2161.1:2000	Occupational protective gloves – Selection, use and maintenance
AS/NZS2161.2:2005	Occupational protective gloves – General Requirements
AS/NZS2161.10.1:2005	Occupational protective gloves – Terminology and Performance requirements
AS/NZS2161.10.2:2005	Occupational protective gloves – Determination of resistance to penetration
AS/NZS2161.10.3:2005	Occupational protective gloves – Determination of resistance to permeation by chemicals
AS/NZS2210.1:2010	Safety, protective and occupational footwear – Guide to selection, care and use
AS/NZS2210.3:2009	Safety, protective and occupational footwear – Specification for safety footwear
AS/NZS2210.4:2009	Safety, protective and occupational footwear – Specification for protective footwear
AS/NZS4501.1:2008	Occupational protective clothing – Guidelines on selection, use and maintenance
AS/NZS4501.2:2006	Occupational protective clothing – General requirements

Section 16 - OTHER INFORMATION

MSDS Dates and Revisions



MSDS Original Preparation Date : 26th November 2004
MSDS Latest Revision Date : 8th November 2017
Sections Changed in Latest Revision : All sections reviewed for WHS compliance
Technical Manager: phone: (03) 9708 9200 fax: (03) 9708 9255
Adrian Hill email: ahill@pqa.com.au
MSDS APPROVED : 8th November 2017

Acronyms Used

ADG Code	Australian Dangerous Goods Code for the Transport of Dangerous Goods by Road & Rail
AICS	Australian Inventory of Chemical Substances
CAS No.	Chemical Abstracts Service Registry Number
GHS	Globally Harmonised System of Classification and Labelling of Chemicals proposed by the UN
IMDG	International Maritime Dangerous Goods Code
IATA	International Air Transport Association
NOHSC	Australian National Occupational Health and Safety Commission
SUSMP	Standard for Uniform Scheduling of Medicines and Poisons
UN No.	United Nations Dangerous Goods Number
WHS	Work Health and Safety legislation introduced by the Australian government which consists of an integrated package of a model Work Health and Safety (WHS) Act supported by WHS Regulations, Codes of Practice and a National Compliance and Enforcement Policy. The WHS Regulations implement a system of chemical hazard classification, labelling and safety data sheet requirements based on the GHS

MSDS Code Used This MSDS has been prepared according to Australian WHS criteria

This MSDS summarises to the best of our knowledge the health and safety hazard information on the product and how to safely handle and use the product in the workplace. Each user should read this MSDS and consider the information in the context of how the product will be handled and used in the workplace, including in conjunction with other products. If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact this company.

PQ Australia gives no warranty as to the fitness of the product for any particular purpose and any implied warranty or condition (statutory or otherwise) is excluded except to the extent that exclusion is prevented by law. PQ Australia accepts no liability for loss or damage (other than that arising from death or personal injury caused by defective product, if proved), resulting from reliance on this information. Freedom under Patents, Copyright and Designs cannot be assumed.