Non-Technical Summary
Blackhill Quarry
Mone Bros Ltd.

Document Reference: 383/1--R1.2 - NTS

MPG

Minerals
Waste
Environment

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SECTION 1: Non-Technical Summary

1.1. Introduction

1.1.1. *The Mineral Planning Group Ltd.* (MPG) have been commissioned by *Mone Brothers Limited* to produce an application for the variation of a Bespoke Permit (ref: EPR/NB3135RJ) to the Environment Agency (EA) for the treatment of non-hazardous wastes to include aggregate washing, an increase in the total permitted tonnages, and additional waste codes at Blackhill Quarry, Kings Road, Bramhope, Leeds, LS16 9JN.

1.1.2. This Non-Technical Summary provides an overview of the application and its supporting documents. The variation seeks to add a washplant for the processing of wastes to create secondary aggregates, which will be added to The Site's WRAP protocol. All other existing permitted activities (the waste disposal and aggregate recycling that doesn't require washing) will remain as existing. Therefore, the supporting information supplied refers only to the addition of the washplant and its impacts, and does not review other permitted activities at The Site.

1.1.3. The new washplant would replace an older crusher and saw shed building, and is electrically powered, generating low noise levels.

1.1.4. The Bespoke Permit application includes the following:

- Non-Technical Summary (NTS)
- Waste Acceptance Procedures (WAP)
- Environmental Risk Assessment (ERA)
- Environmental Management System (EMS) Summary
- Noise Minimisation Plan
- Water storage calculation report
- Dust Emissions Management Plan (for reference only, no change from existing)

- Supporting Plans
- Application Forms

1.2. Site Description

1.2.1. The Site is located to the south of the Kings Road, Leeds, LS16 9JN and is currently an active quarry extracting gritstone and clay covering an area of approximately 9.5ha. Operations at the site also includes the stockpiling of gritstone and the recycling / processing of inert materials.

1.2.2. The Site has a Bespoke Permit (EPR/NB3135RJ) for the operation of a landfill site, inert material recovery and recycling. It is not proposed to change the landfill operations permitted at The Site.

1.2.3. The existing green line boundary is shown on Drawing ref: *383/1 – Permit-1*. This will remain unchanged.

1.2.4. The Site is bounded to the:

- North by agricultural fields (separated by Kings Road).
- South by Golden Acre Park, which is a public park comprising woodland, a lake, recreational facilities and cafe (the cafe is over 350m from the site boundary).
- East by agricultural fields (separated by Arthington Road).
- West by agricultural fields.

1.3. Operational Overview

1.3.1. The proposed Permit Variation seeks to include aggregate washing, for recovery as a soil, soil substitute or aggregate, increase the total tonnage, and add additional waste codes. The full list of waste codes that would be accepted at

The Site is included as Table 1 of the Waste Acceptance Procedures (383/1—R1.1 – WAP). The waste codes match those in the existing Bespoke Permit, and the following waste codes are proposed to be added:

- 17 03 02 – bituminous mixtures (road planings only)
- 17 05 06 – dredging
- 17 09 04 – mixed construction and demolition
- 19 12 09 – minerals such as sand and stone

1.3.2. The activities proposed at The Site under the proposed varied permit would add washing of waste to produce a non-waste product under a quality protocol (in addition to the already permitted activities). The treatments at The Site would, as a result of the variation, include washing using a *CDE* wash plant. In addition, the maximum annual throughput tonnage would be increased from 74,999 tonnes to 150,000 tonnes.

1.3.3. The wash plant will be a closed-system requiring no water discharge and will be topped-up, when required, from an existing groundwater borehole. Only small volumes of water remaining in the final products, and via evaporation from open tanks, would be lost from the system. The plant's manufacturer states that approximately 96% of water remains in the system, whilst approximately 4% is lost as moisture in final products.

1.3.4. Surface water run-off from the wash plant area and incoming waste storage area (as shown on drawing ref: *383/1 – Master Plan – 1*) would be directed via trench drains to a lined storage lagoon, before being discharged to The Site's main lagoon (after testing, see section 1.4). The required size of the storage lagoon has been calculated based on a maximum emptying frequency of every two weeks, and the average winter rainfall plus a 1 in 30 year storm event, plus 25% for climate change.

1.3.5. The approximate location of the aggregate recycling operation and wash plant is shown in drawing ref: *383/1 – Master Plan -1*.

1.3.6. Not all waste would be treated through the wash plant. Some wastes may continue to be suitable for dry processing only, through mechanical processes such as screening and crushing, which would result in a variety of aggregate products, as is currently carried out at The Site.

1.3.7. Waste would arrive at The Site by HGV, then would be deposited in the waste stockpiling area. The waste would then be treated appropriately (depending on the final product being produced). Once treated, the materials will have reached End of Waste (EoW) status and be considered a specified, saleable product. Different products would be separately stockpiled before being loaded to HGVs for delivery to customers.

1.3.8. Not all waste arriving at The Site and intended for washing would require crushing and / or screening at The Site, as a proportion would have been pre-screened at Mone Bros Ltd's other permitted facilities.

1.4. Operational Controls

1.4.1. The Site operates under an Environmental Management System (EMS), which would be updated in-line with the Environment Agency's current guidance to reflect the changes to the operations at The Site.

1.4.2. The EMS will be strictly adhered to with Waste Acceptance Procedures, as detailed in Document ref: *383/1 -- WAP – R1.1,* being tightly controlled, and any appropriate measures identified as required to control potential impacts from the development would be put in place.

1.4.3. A testing regime for the water used in the wash plant would be implemented to ensure it remains suitable for washing and will not contaminate the final products. The thresholds for determining whether water needs to be replaced are those included in Table 3, Tier 2 Criteria, Protection of Controlled Waters (attached as Appendix A). Should any of the thresholds be breached, the system would be

drained to a tanker and removed from The Site to a suitably licenced facility.

1.4.4. The washplant typically operates using a flocculent. Currently it is proposed to use BIOFLOC V 5106 K (Material Safety Data Sheet and Specification provided as Appendix C).

1.4.5. Water would be tested monthly, using samples from the clarified water tank, the deep cone (silt separation) tank, and the borehole from which clean water is sourced.

1.4.6. In addition, the operator would carry out continual daily visual checks for non-conforming materials or contaminants such as oil sheens or visible grease.

1.4.7. Water in the storage lagoon would also be tested. Should no thresholds be breached, this water would be transferred into The Site's main lagoon. Should thresholds be breached, water would be removed from the storage lagoon and taken to a suitably licenced facility.

1.4.8. The recycling process results in the following products, which would be recycled under the Quality Protocol: aggregates from inert waste:

- 0-2mm washed fill sand
- 0-4mm washed grit sand
- 4-10mm washed recycled aggregate
- 10-20mm washed recycled aggregate
- 20-40mm washed recycled aggregate
- 80mm+ oversized

1.4.9. The following products (with likely waste codes suggested below) would be separated out as part of the recycling process:

- Metals (19 12 02)
- Polystyrene (19 12 12)

- Organics / Lights (19 12 12)

1.4.10. All of these materials are appropriately classified and removed from The Site to a suitably licensed facility. All such materials would be stored in a separate skip prior to removal.

Appendix A: Water Testing Regime

1.0 Water at The Site would be tested in four locations:

- The borehole from which water is sourced
- The clarified water tank
- The deep cone separation tank
- The storage lagoon

2.0 The testing regime will measure the concentration of a number of potential contaminants and compare these against thresholds. Should any of the thresholds be breached at any point, the water would be drained (either from the washplant or the lagoon). Should the washplant require draining, due to the nature of its operation, initially 50% of the water would be drained, the plant topped up, and further tests carried out, with this process repeated until such time as the thresholds are no longer being breached.

3.0 The washplant can be drained via the drainage valve, which could be connected to a tanker for removal. The washplant itself would be cleaned by flushing with new, clean water, if this is deemed necessary.

4.0 Should the results of testing the borehole water show any breaches, an investigation into the possible causes of this would be carried out. If necessary, remedial action such as pre-treating the water may be necessary. In any event, more frequent testing would be carried out until the contaminant levels have returned to normal.

5.0 <u>Testing Frequency</u>

- The borehole from which water is sourced - Quarterly
- The clarified water tank - Weekly
- The deep cone separation tank - Weekly
- The storage lagoon – Every 2 weeks (or prior to emptying, whichever is the sooner)

6.0 Other Testing

6.1 All final products are subjected to further physical and chemical testing to ensure they meet specification. These tests are carried out at regular intervals (in accordance with the quality protocol).

6.2 If contaminants are detected to an unacceptable level in the final products, these products would be quarantined and removed to a suitably licensed waste site. If contaminant levels in the water are detected, then a full investigation will take place as to the source of the contamination and all washing operations will cease until the issue is rectified.

7.0 Testing Parameters

7.1 The thresholds for determining whether water needs to be replaced are those included in Table 3, Tier 2 Criteria, Protection of Controlled Waters (Attached as Appendix B).

Appendix B: Water testing parameters

1 Introduction

The aim of this document is to present an explanation for the selection of the assessment criteria routinely used by PBA when undertaking a Tier 2 contamination risk assessment. Any deviation from the routine criteria and/or selection of criteria for parameters not covered in this document will be described in the report text.

A Tier 2 assessment is a quantitative assessment using published criteria to "screen" the site-specific contamination testing data and identify potential hazards to specific receptors. Generic criteria are typically cautious in derivation and exceedance does not indicate that a site is statutorily contaminated and/or necessarily unsuitable for use in the planning context. These criteria are used to identify situations where further assessment and/or action is required.

This document is divided into general introductory text and sections on soils, waters and soil gases.

2 General Notes

This document should be read in conjunction with another entitled "PBA Methodology for Assessment of Land Contamination" which summarises the legislative regime and our approach to ground contamination and risk assessment.

Any PBA interpretation of contamination test results is based on a scientific and engineering appraisal. The perceptions of, for example, banks, insurers, lay people etc are not taken into account.

Any tables included in this document are produced for ease of reference to the criteria, they do not in any way replace the documents of origin (which are fully referenced) and which should be read to ensure appropriate use and interpretation of the data.

Generic criteria provide an aid to decision-making, but they do not replace the need for sound professional judgement in risk assessment (EA, 2006b). The criteria are based on numerous and complex assumptions. The appropriateness of these assumptions in a site-specific context requires confirmation on a project by project basis. Our interpretative report will comment on the appropriateness of the routine criteria for project objectives or ground conditions. It is important to note that if the use of the published criteria is challenged, it may be necessary to carry out modelling to generate site-specific assessment criteria.

3 Criteria for Assessing Soil Results

3.1 Potential Harm to Human Health

The criteria routinely used by PBA as Tier 2 soil screening values for the protection of human health are:-

- Soil Guidance Values (SGVs) published in 2009 using CLEAv1.06,
- Category 4 Screening Levels (C4SLs) published in 2014 which adopt a "low level of toxicological concern" (LLTC) as the toxicological benchmark
- Suitable 4 Use Levels (S4ULs) published in 2015 which adopt a minimal or torable risk as described in SR2 (EA 2009c).

The criteria have been generated using the Contaminated Land Exposure Assessment model (CLEA) and supporting technical guidance (EA, 2009a, 2009b, 2009c). The CLEA model uses generic assumptions about the fate and transport of chemicals in the environment and a generic conceptual model for site conditions and human behaviour to estimate child and adult exposures to soil contaminants for those potentially living, working, and/or playing on contaminated sites over long time periods (EA, 2009b).

The CLEA software 2009 has changed significantly since 2005 and is now a deterministic model. The CLEA model has been updated to incorporate the changes to exposure assessments. The software was amended to version 1.06 to fix some bugs. The handbook referring to version 1.05 is still valid as the functionality has not changed between version 1.05 and 1.06. The software has not been updated to incorporate Defra's revised Statutory Guidance (SG) (CL:AIRE 2013).

The CLEA model uses ten exposure pathways (Ingestion (outdoor soil, indoor dust, homegrown vegetables and soil attached to homegrown vegetables), Dermal Contact (outdoor soil and indoor dust) and Inhalation (outdoor dust, indoor dust, outdoor vapours and indoor vapours)). There are exposure pathways not included in the CLEA model such as the permeation of organics into plastic water supply pipes.

The presence and/or significance of each of the potential exposure pathways is dependant on the land use being considered. The model uses standard land use scenarios as follows:-

Residential – habitation of a dwelling up to two storeys high with various default material and design parameters, access to either private or nearby community open space with soil track back to form indoor dust. Assumes ingestion of homegrown produce.

Allotments – the model has default parameters

for use and consumption of vegetables but not animals or their products (eggs).

Industrial/commercial – assumes office or light physical work in a permanent three storey structure with breaks taken outside and that the site is NOT covered in hardstanding.

Recent guidance (Defra 2012) introduces a four stage classification system where Category 1 sites are obviously contaminated and Category 4 sites uncontaminated as defined by EPA 1990. Outside of these categories further specific risk assessment is required to determine if the site should fall into Category 2 contaminated or category 3 uncontaminated. Category 4 screening values are considered to be more pragmatic than the current published SGV/GAC criteria but still strongly precautionary with the aim of allowing rapid identification of sites where the risk is above minimal but still low/acceptable (within the context of Part 2A).

At the end of 2013 technical guidance in support of Defra's revised Statutory Guidance (SG) was published (CL:AIRE 2013) which provided:

• A methodology for deriving C4SLs for the standard land-uses and two new public open space scenarios using the updated assumptions relating to the modelling of human exposure to soil contaminants; and

• A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

Following issue of an Erratum in December 2014 a Policy Companion Document was published (Defra 2014B).

Soil Guideline Values (SGVs)

The first series of SGVs were generated using a probabilistic version of the CLEA model. However, on 22 July 2008 DEFRA announced the withdrawal of these SGVs and revised SGVs were calculated for all substances except lead using a deterministic version of the CLEA model (v1.05). Table 1 presents the SGVs which have not been withdrawn but it should be noted that they were developed using assumptions for body weight and inhalation rates that have been revised since publication.

Category 4 Screening Levels (C4SLs)

Table 6 summarises the C4SL (DEFRA 2014B) for each of the six substances. PBA will use the criteria for lead and may use the other criterion, depending on site specific conditions.

Suitable 4 Use Levels (S4ULs)

In July 2009, Generic Assessment Criteria (GACs) for 82 substances were published by the Chartered Institute of Environmental Health (CIEH) (LQM and CIEH, 2009) using the then current version of the CLEA software v1.04 and replacing those generated in 2006 using the original version of the model CLEA UK *beta*. In 2015 S4ULs were published by LQM/CIEH to replace the second edition GACs. Table 7 summarises the S4ULs.

Note on Mercury, Chromium and Arsenic Assessment The analytical testing routinely undertaken by PBA determines total concentration, however, the toxicity depends on the form of the contaminant.

If a source of Mercury, Chromium or Arsenic is identified or the total concentration exceeds the relevant worst case speciated criteria it will be desirable/necessary to undertake additional speciated testing and further assessment.

Note on Asbestos

Asbestos in soil and made ground is currently under review by a number of bodies. There are no current published guidance values for asbestos in soil other than the waste classification values given in the EA's Technical Guidance WM2, Hazardous Waste – Interpretation of the definition and classification of hazard waste (3d Edition, 2013). This guidance is only appropriate for soils that are being discarded as waste.

Testing for asbestos will be carried out on selected samples of made ground encountered during investigation, initially samples will be subjected to an asbestos screen and, if asbestos is found to be present, subjected to quantification depending on the project specific requirements. The reader is directed to the report text for guidance on the approach adopted in respect to any asbestos found to be present. Further guidance is also available in the 2014 CIRIA publication C733, Asbestos in soil and made ground: a guide to understanding and managing risks.

Note on the use of C4SLs

A letter from Lord de Mauley dated 3rd September 2014 provides more explicit direction to local authorities on the use of the C4SL in a planning context. The letter identifies four key points:

1) that the screening values were developed expressly with the planning regime in mind

2) their use is recommended in DCLG's planning guidance

3) soil concentrations below a C4SL limit are considered to be 'definitely not contaminated' under Part IIA of the 1990 Environmental Protection Act and pose at most a 'low level of toxicological concern' and

4) exceedance of a C4SL screening value does not mean that land is definitely contaminated, just that further investigation may be warranted.

3.2 Potential Harm to the Built Environment

Land contamination can pose risks to buildings,

building materials and services (BBM&S) in a number of ways. Volatile contaminants and gases can accumulate and cause explosion or fire. Foundations and buried services can be damaged by corrosive substances and contaminants such as steel slags can create unstable ground conditions through expansion causing structural damage. PBA use the following primary guidance to assess the significance of soil chemistry with respect to its potential to harm the built environment.

i) Approved Document C - Site Preparation and Resistance to Contaminants and Moisture. (DCLG 2010);

ii) Concrete in aggressive ground SD1 (BRE 2005);

iii) Guidance for the selection of water supply pipes to be used in brownfield sites (UKWIR 2011);

iv) Protocols published by agreement between Water UK and the Home Builders Federation providing supplementary guidance which includes the Risk Assessment for Water Pipes (the 'RA') (Water UK 2014).

v) Performance of Building Materials in Contaminated Land report BR255 (BRE 1994).

vi) Risks of Contaminated Land to Buildings, Building Materials and Services. A Literature Review - Technical Report P331 (EA 2000).

vii) Guidance on assessing and managing risks to buildings from land contamination - Technical Report P5 035/TR/01 (EA 2001).

3.3 Potential to Harm Ecosystems, Animals, Crops etc

The criteria routinely used by PBA as Tier 2 screening values to assess the potential of soil chemistry to harm ecosystems are taken from the following guidance and summarised in are given in Table 2.

i) Ecological Risk Assessment (ERA) Science Report Series SC070009, published by the Environment Agency, Bristol (EA, 2008);

ii) The Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing (ICRCL 70/90, 1990); and

iii) Code of Practice for Agricultural Use of Sewage Sludge 2nd Edition (DOE, 2006).

iv) BS 3882:2007 Specification for topsoil and requirements for use. Unless stated in the report the assessment is solely for phytotoxic parameters and additional assessment is required to determine suitability as a growing medium.

4 Criteria for Assessing Liquid Results

4.1 Potential Harm to Human Health

The criteria routinely used by PBA as Tier 2 water screening values (Table 3) are taken from the Water Supply (Water Quality) Regulations (Defra 2010). It should be noted that some of the prescribed concentrations listed in the Water Supply Regulations have been set for reasons other than their potential to cause harm to human health. The concentrations of iron and manganese are controlled because they may taint potable water with an undesirable taste, odour or colour or may potentially deposit precipitates in water supply pipes.

4.2 Potential to Harm Controlled Waters

Controlled Waters are rivers, estuaries, coastal waters, lakes and groundwaters. Water in the unsaturated zone is not groundwater but does come within the scope of the term "ground waters" as used and defined in the Water Resources Act 1991. It will continue to be a technical decision for the Environment Agency to determine what is groundwater in certain circumstances for the purposes of the Regulations. The approach adopted by PBA considers the objectives of the Water Framework Diredctive (WFD) and the Groundwater Daughter Directive (GWDD) (refer to PBA Methodology).

When assessing ground condition data the aim is to identify whether there could be an environmentally significant input to groundwater. An environmentally insignificant input into groundwater would be one that could not have any effect on (i) any of the receptors noted in the Water Framework/GWDD definition of pollution (ii) the chemical status of a groundwater body; or (iii) could give rise to a significant and sustained rising trend in the concentrations of pollutants in groundwater as noted in those directives. PBA uses the approach presented in Groundwater Protection Policy and Practice (GP3) (EA 2013). The criteria routinely used by PBA as Tier 2 screening values (Tables 3, 4 and 5) are taken from directions to the Environment Agency (EA 2010). Reference is also made to Directive 2013/39/EU (12 August 2013) amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy. While the Directive has yet to be transposed, it is intended that the standards it sets will apply for the purposes of the second cycle of river basin plans.

The 2014 Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment - Directions to the Environment Agency relating to the Groundwater Directive

(Directive 2006/118/EC) informs interested parties of the new and updated environmental standards to be used in the second cycle of Water Framework Directive (2000/60/EC) river basin management planning process in England and Wales. It also presents new and updated assessment criteria for biological elements that must be monitored to assess the ecological status of surface water bodies. The relevant Directions to the Environment Agency and Natural Resources Wales (referred to hereafter as the Agencies) will be updated to give legal effect to the standards (currently not updated).

5 Criteria for Assessing Gas Results

PBA use the following primary guidance on gas monitoring methods and strategy, the assessment of risk posed by soil gases (including Volatile Organic Compounds (VOCs)) and mitigation measures/risk reduction during site development.

i) BS 8576:2013 – Guidance on Ground Gas Investigations: Permanent gases and Volatile Organic Compounds (VOCs). (BSI 2013)

ii) A pragmatic approach to Ground Gas Risk Assessment. CL:AIRE Research Bulletin RB17 (Card 2012)

iii) The VOCs Handbook. C682 (CIRIA 2009).

iv) Assessing risks posed by hazardous gases to buildings C665 (CIRIA 2007);

v) Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present. (NHBC 2007); and

vi) Code of practice for the characterization and remediation from ground gas in affected developments BS 8485 (BSI 2007)

Gas and borehole flow data are used to obtain the gas screening value (GSV) for methane and carbon dioxide. The GSV is used to establish the characteristic situation and to make recommendations for gas protection measures for buildings if required.

Radon

PBA use the following primary guidance to assess the significance of the radon content of soil gas.

i) Radon: guidance on protective measures for new dwellings. Report BR211 (BRE, 2007); and

ii) Radon Atlas of England, R290 (NRPB, 1996).

6 References

BRE (2005) Concrete in aggressive ground. Special Digest 1, Building Research Establishment, Garston, Herts.

BRE (2007) Radon: guidance on protective measures for new dwellings. Report BR211, Building Research Establishment, Garston, Herts.

BSI (2007) BS 8485:2007 Code of practice for the characterization and remediation from ground gas in affected developments. British Standards Institute, London.

BSI (2011) BS10175:2011 +A1:2013 Investigation of contaminated sites – code of practice. British Standards Institute, London.

BSI (2013) BS 8576:2013 – Guidance on Ground Gas Investigations : Permanent gases and Volatile Organic Compounds (VOCs). British Standards Institute, London.

Card G, Wilson S, Mortimer S. (2012). A Pragmatic Approach to Ground Gas Risk Assessment. CL:AIRE Research Bulletin RB17. CL:AIRE, London, UK. ISSN 2047-6450 (Online)

CIRIA (2007) Assessing risks posed by hazardous gases to buildings. C665, Construction Industry Research and Information Association, London.

CL:AIRE (2010) Soil Generic Assessment Criteria for Human Health Risk Assessment. Published in January 2010 by Contaminated Land: Applications in Real Environments, London. ISBN 978-1-905046-20-1.

CL:AIRE (2013) SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report published by Contaminated Land: Applications in Real Environments (CL:AIRE) 20th December 2013

CLAN2-05 Contaminated land advice note 02 from September 2005. Department for the Environment, Food and Rural Affairs, London.

CLSD (2009) Contaminated-Land-Strategies Digest - 30 Apr 2009 to 1 May 2009 - Special issue (#2009-89). Posting titled: “JISCmail GACs for SGV substances: April 2009 and subsequent postings”.

DCLG (2013) Approved Document C - Site preparation and resistance to contaminates and moisture (2004 Edition incorporating 2010 and 2013 amendments).

Defra (2010) The Water Supply (Water Quality) Regulations, 2010. Statutory Instrument 2010 No 944, Department of the Environment, Transport and the Regions, London.

Defra (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance.

Defra (2014) Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment

Defra (2014B) SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document. Department for Environment, Food and Rural Affairs December 2014

DoE (2006) Code of Practice for Agricultural Use of Sewage Sludge. Department of the Environment, London.

EA (2004) Guidance on Assessment of Risks from Landfill Sites. Environment Agency, Bristol.

EA (2006b) CLEA update No. 4. Environment Agency, Bristol.

EA (2008) Ecological Risk Assessment (ERA). Science Report Series SC070009, Environment Agency, Bristol.

EA (2009a) Using Soil Guideline Values. Science Report SC050021/SGV Introduction. Environment Agency, Bristol.

EA (2009b) Updated Technical Background to the CLEA model. Science Report SC050021/SR3 Introduction. Environment Agency, Bristol.

EA (2009c) Human health toxicological assessment of contaminants in soil. Science Report SC050021/SR2. Environment Agency, Bristol.

EA (2009d) Compilation data for priority organic contaminants for derivation of soil guideline values Science Report SC50021/SR7

EA (2009e) CLEA Software (Version 1.05) Handbook Science Report SC050021/SR4

EA (2010) River Basin DistrictsTypology, Standards and Groundwater Threshold Values (Water Framework Directive) England and Wales) Directions 2010.

EA (2013) Groundwater Protection Policy and Practice (GP3) August 2013 Version 1.1

ICRCL (1990) The Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing 70/90. Interdepartmental Committee on the Redevelopment of Contaminated Land, London.

LQM & CIEH (2006) Generic Assessment Criteria for Human Health Risk Assessment. Land Quality Management Limited and the Chartered Institute of Environmental Health, London.

LQM & CIEH (2009) The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition). Land Quality Press, Nottingham. ISBN 0-9547474-7-X.

LQM & CIEH (2015) The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

NRPB (1996) Radon Atlas of England. R290, National Radiological Protection Board, Didcot, Oxfordshire.

NHBC (2007) Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present. National House Building Council.

UKWIR (2011) Guidance for the selection of Water Pipes to be used in Brownfield Sites.

Water UK 2014 Contaminated Land Assessment Guidance

Table 1: Tier 2 Criteria for the Assessment of Potential Contaminant Concentrations in Soil – Protection of Human Health Published Soil Guideline Value (2009) with SOM of 6%

Determinand	Allotments	Residential with plant uptake	Commercial/ Industrial
Arsenic (Inorganic)	43	32	640
Cadmium	1.8	10	230
Mercury (elemental)	1	26	26
Mercury (inorganic)	80	170	3600
Methyl Mercury	8	11	410
Nickel	230	130	1800
Selenium	120	350	13000
Benzene	0.07	0.33	95
Toluene	120	610	4400
Ethylbenzene	90	350	2800
Xylenes #	160	230	2600
Phenol	280	420	3200
Dioxins, Furans and dioxin-like PCBs *	0.008	0.008	0.24

Units mg/kg
from the three isomers the most conservative criterion has been selected for each scenario
* these SGVs are now recognised to have limitations and should be used with caution

Table 2 Tier 2 Criteria for the Assessment of Potential Contaminant Concentrations in Soil – Protection of Ecological Systems

Parameter	ICRCL 70/90 [a]		Proposed SSVs [b]	Code of Practice for Agricultural Use of Sewage Sludge [c]	BS 3882:2007 Specification for topsoil and requirements for use
	Maximum				Phytotoxic contaminants
	Livestock	Crop Growth			
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kgDS
Benzo(a)pyrene			0.15		
Arsenic	500	1000		50	
Cadmium	30	50	1.15	3	
Chromium			21.1	400	
Copper	500	250	88.4	80/ 100/ 135/ 200 [e]	<100/<135/<200 [f]
Fluoride	1000			500	
Lead	1000		167.9	300	
Mercury			0.06	1	
Molybdenum				4	
Nickel			25.1	50/ 60/ 75/ 110 [e]	<60/<75/<110 [f]
Pentachlorobenzene			0.029		
Pentachlorophenol			0.6		
Selenium				3	
Tetrachloroethene			0.01		
Toluene			0.3		
Zinc	3000	1000	90.1	200/200/200/300 [e]	<200/<200/<300 [f]

a. Interdepartmental Committee on the Redevelopment of Contaminated Land (ICRCL) 70/90 Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing 1st edition 1990.
b. Proposed Soil Screening Values (SSVs) – Consultation, Environment Agency 2008. Threshold which if exceeded prompts further assessment.
c. Maximum permissible concentration of potentially toxic elements from the Code of Practice for Agricultural Use of Sewage Sludge. Second Edition. DOE 2006.
d. Concentrations are for contamination derived from mine spoil. In other situations the speciation may be more available. Factors include total concentration, speciation, particle size, pH, species of plant, type of animal/grazing habit.
e. Where four values are presented, concentrations are for soils with pH values 5.0-5.5/ 5.5-6.0/ 6.0-7.0/ >7.0
f. Where three values are presented, concentrations are for soils with pH values <6.0/ 6.0-7.0/ >7.0

Table 3: Tier 2 Criteria for Screening Selected Contaminants in Groundwater

Parameter	Protection of Human Health	Protection of Controlled Waters			
	Water Supply (Water Quality) Regulations 2000	Test 2 Minimum	Test 2 Maximum	Test 4	Test 5
Metal/Semi Metal:					
Antimony (µg/l)	5				
Arsenic (µg/l)	10	51.6	199	7.5	
Boron (µg/l)	1000			750	
Cadmium (µg/l)	5	0.2	1.1	3.75	
Chromium (µg/l)	50	5	27.6	37.5	
Copper (µg/l)	2000	10.1	57.8	1500	
Iron (µg/l)	200				
Lead (µg/l)	25 (10 from 25/12/13)	7.3	39.8	18.8	
Manganese (µg/l)	50				
Mercury (µg/l)	1			0.75	
Nickel (µg/l)	20	20.2	116	15	
Selenium (µg/l)	10				
Zinc (µg/l)	-	75.8	414	3750	
Other:					
Ammonium NH4 (mg/l)	0.5				
Ammonia NH3 (mg/l)	-	0.3	1.73	0.29	0.29
Chloride (mg/l)	250			188	187.5
Cyanide (ug/l)	50				
Electrical Conductivity (µS/cm)	2500			1880	
pH (pH units)	6.5 to 10				
Nitrate NO3 (mg/l)	50			42	42
Sulphate (mg/l)	250			188	188
Organics:					
Anthracene		0.1	0.55		
Benzene (µg/l)	1	10.1	55.2	0.75	0.75
Benzo(a)pyrene (µg/l)	0.01			0.075	
Chloroform (µg/l)	100 a	2.53	13.8	75	75
1.2-Dichloroethane (µg/l)	3			2.25	2.25
Fluoranthene		0.1	0.6		
Naphthalene (µg/l)	-	2.4	13.2		
Phenol Total (mg/l)	0.5	15.2	82.8		
PAHs (µg/l)	0.1 b				
Pesticides (ug/l)	0.03c				
Toluene (µg/l)	-	50.5	276		
Trichloroethene TCE (µg/l)	10 d	10.1	55.2	7.5	7.5
Tetrachloroethene PCE (µg/l)	10 d	10.1	57.8	7.5	7.5
Tetrachoromethane (ug/l)	3				
Vinyl Chloride (µg/l)	0.5				
Xylene (µg/l)	-	30.3	166		

Notes

TV Threshold Values for each groundwater body are given in the River Basin Management Plans (RBMP)
Test 2 Groundwater Impacts on Surface Water – Minimum is the lowest TV for any RBMP
Test 4 Groundwater Drinking Water Protected Areas – designed to be equivalent to a 95% standard
Test 5 General Quality of Groundwater Body – designed to be equivalent to a 95% standard

a. Sum for Tri-halomethanes – chloroform, bromoform, dibromochloromethane, bromodichloromethane
b. Concentration for sum of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene
c. Sum for Aldrin, Dieldrin, Heptachor and Heptachor epoxide
d. Sum of TCE and PCE

Table 4a : Specific Pollutants – Currently Inforce

Pollutant	Rivers and Freshwater Lakes	Transitional and Coastal Waters
2,4-Dichlorophenoxyacetic acid (2,4-D)	0.3 (1.3)*	0.3 (1.3)*
2,4-Dichlorophenol	20	20
Ammonia (Un-ionised) as Nitrogen	Not applicable	21
Arsenic #	50	25
Chlorine (total available)	2 (5)*	(10)*
Chromium VI	3.4	0.6 (32)*
Chromium III	4.7	(32)*
Copper – standard is hardness dependant for freshwater	1/ 6 /10/ 28	5
Cyanide	1 (5)*	1 (5)*
Cypermethrin as ng/l	0.1 (0.4)*	0.1 (0.4)*
Diazinon	0.01 (0.02)*	0.01 (0.1)*
Dimethoate	0.48 (4)*	0.48 (4)*
Iron as mg/l	1	1
Linuron	0.5 (0.9)*	0.5 (0.9)*
Mecoprop	18 (187)*	18 (187)*
Permethrin	(0.01)	(0.01)
Phenol	7.7 (46)*	7.7 (46)*
Toluene	50 (380)*	40 (370)*
Zinc – standard is hardness dependant for freshwater	8/ 50/ 75/ 125	40

i. All units ug/l unless otherwise stated.
ii. The standard is the annual mean standard over a period of 12 consecutive months unless otherwise stated.
iii. Values in brackets ( ) indicates the 95-percentile standard where the standard is exceeded if the measured concentration is above the standard for 5% or more of the time.
iv. Values marked * indicate that the standard is not to be used for the purpose of classifying the ecological status or potential of bodies of surface water.
v. # indicates that the standard is the dissolved fraction obtained by filtration through a 0.45um filter.
vi. Where four values are presented, concentrations are for soils with $CaCO_3$ concentration <50/50-100/100-250/>250 mg/l

Reproduced from Part 4 of The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Direction 2010.

Table 4b Proposed Standards for 29 specific pollutants

Substances	All Concentrations in ug/l				Standard Existing-E Revised-R New-N
	Fresh water		Salt water		
	Long-term (Mean)	Short- term (95 percentile)	Long-term (Mean)	Short- term (95 percentile)	
Unionised ammonia	---	---	21	---	E
Arsenic	50	---	25	---	E
Benzyl butyl phthalate	7.5	51	0.75	10	N
Carbendazim	0.15	0.7	---	---	N
Chlorothalonil	0.035	1.2	---	---	N
Chromium(III)	4.7	32	---	---	E
Chromium(VI)	3.4	---	0.6	32	E
Chlorine	2	5	---	10	E
Copper bioavailable	1		3.76 dissolved, where DOC ≤1mg/l 3.76 + (2.677 x ((DOC/2)–0.5)) dissolved, where DOC >1mg/l		R
Cyanide	1	5	1	5	E
Cypermethrin[1]	0.1	0.4	0.1	0.4	E
Diazinon	0.01	0.02	0.01	0.26	R/E
2,4- dichlorophenol	4.2	140	0.42	6	R
2,4- dichlorophenoxyacetic acid	0.3	1.3	0.3	1.3	E
3,4- dichloroaniline	0.2	5.4	0.2	5.4	N
Dimethoate	0.48	4.0	0.48	4.0	E
Glyphosate	196	398	196	398	N
Iron	1	---	1	---	E
Linuron	0.5	0.9	0.5	0.9	E
Manganese bioavailable	123	---	---	---	N
Mecoprop	18	187	18	187	E
Methiocarb	0.01	0.77	---	---	N
Pendimethalin	0.3	0.58	---	---	N
Permethrin	0.001	0.01	0.0002	0.001	R
Phenol	7.7	46	7.7	46	E
Tetrachloroethane	140	1848	---	---	N
Triclosan	0.1	0.28	0.1	0.28	N
Toluene	74	380	74	370	R/E
Zinc bioavailable	10.9 plus Ambient Background Concentration (μg/l) dissolved		6.8 dissolved plus Ambient Background Concentration (μg/l)		R

[1] Note that cypermethrin becomes a Priority Substance under 2013/39/EU but there will be a transitional period before the PS standards apply.

Table 5: Surface Waters - Priority Substances – Standards for Chemical Status

Pollutant	Annual Average		Maximum Allowable Concentration	
	Inland	Other	Inland	Other
Alachlor	0.3	0.3	0.7	0.7
Anthracene	1.0 (0.1)	1.0 (0.1)	0.1	0.1
Atrazine	0.6	0.6	2.0	2.0
Benzene	10	8	50	50
Brominated diphenylether	0.0005 (NA)	0.0005 (NA)	0.14	0.014
Cadmium (and its compounds) # – hardness dependant	<0.08/ 0.08/ 0.09/ 0.15/ 0.25	0.2	<0.45/ 0.45/ 0.6/ 0.9 / 1.5	<0.45/ 0.45/ 0.6/ 0.9/ 1.5
Carbon tetrachloride	12	12	NA	NA
C10-13 Chloroalkanes	0.4	0.4	1.4	1.4
Chlorfenvinphos	0.1	0.1	0.3	0.3
Chlorpyrifos	0.03	0.03	0.1	0.1
Aldrin, Dieldin, Endrin, Isodrin (Sum)	0.01	0.005	NA	NA
DDT Total	0.025	0.25	NA	NA
Para-para-DDT	0.01	0.01	NA	NA
1,2-Dichloroethane	10	10	NA	NA
Dichloromethane	20	20	NA	NA
Di(2-ethylhexyl)-phthalate (DEHP)	1.3	1.3	NA	NA
Diuron	0.2	0.2	1.8	1.8
Endosulfan	0.005	0.0005	0.01	0.004
Fluoranthene	0.1 (0.0063)	0.1 (0.0063)	0.12	0.12
Hexachlorobenzene	0.01 (NA)	0.01 (NA)	0.05	0.05
Hexachlorobutadiene	0.1 (NA)	0.1 (NA)	0.6	0.6
Hexachlorocyclohexane	0.02	0.002	0.04	0.02
Isoproturon	0.3	0.3	1	1
Lead (and its compounds) #	7.2 (1.2)	7.2 (1.3)	14	14
Mercury (and its compounds) #	0.05 (NA)	0.05 (NA)	0.07	0.07
Naphthalene	2.4 (2.0)	1.2 (2.0)	130	130
Nickel (and its compounds) #	20 (4)	20 (8.6)	34	34
Nonylphenol	0.3	0.3	2	2
Octylphenol	0.1	0.01	NA	NA
Pentachlorobenzene	0.007	0.0007	NA	NA
Pentachlorophenol	0.4	0.4	1	1
Benzo(a)pyrene (v)	0.05 (0.00017)	0.05 (0.00017)	0.27	0.027
Benzo(b)fluoranthene (v)	0.03 (NA)	0.03 (NA)	NA	NA
Benzo(k)fluoranthene (v)	0.03 (NA)	0.03 (NA)	0.017	0.017
Benzo(ghi)perylene (v)	0.002 (NA)	0.002 (NA)	0.017	0.017
Indeno(1,2,3-cd)pyrene (v)	0.002 (NA)	0.002 (NA)	0.017	0.017
Simazine	1	1	4	4
Tetrachloroethylene	10	10	NA	NA
Trichloroethylene	10	10	NA	NA
Tributyl tin compounds	0.0002	0.0002	0.0015	0.0015
Trichlorobenzenes	0.4	0.4	NA	NA
Trichloromethane	2.5	2.5	NA	NA
Tifluralin	0.03	0.03	NA	NA
Dicofol	0.0013	0.000032	NA	NA
PFOS (9.1)	0.00065	0.00013	36	7.2
Quinoxyfen	0.15	0.015	2.7	0.54
Dioxins and like compounds			NA	NA

Pollutant	Annual Average		Maximum Allowable Concentration	
	Inland	Other	Inland	Other
Aclonifen	0.12	0.012	0.12	0.012
Bifenox	0.012	0.0012	0.04	0.004
Cybutryne	0.0025	0.0025	0.016	0.016
Cypermethrin	0.00008	0.000008	0.0006	0.00006
Dichlorvos	0.0006	0.00006	0.0007	0.00007
HBCDD	0.0016	0.0008	0.5	0.05
Heptachlor and heptachlor epoxide	$2x10^{-7}$	$1x10^{-8}$	$3x10^{-4}$	$3x10^{-5}$
Terbutryn	0.065	0.0065	0.34	0.034

i. Units ug/l
ii. The EQS are expressed as total concentrations in the whole water sample except for #.
iii. # indicates that the EQS is dissolved concentration obtained by filtration through 0.45um filter.
iv. Inland = surface waters encompassing rivers and lakes and related artificial or heavily modified water bodies.
v. Hardness Classifications; Where five values are presented, concentrations are for soils with CaCO3 concentration <40/ 40-50/ 50-100/ 100-200/>200 mg/l
vi. For the group of priority substances of polycyclic aromatic hydrocarbons (PAHs) benzo(a)pyrene can be considered a marker for the other PAHs and therefore only this substance need be monitored

New or revised substance in Directive 2013/39/EU BUT currently without revised Direction – the additions and revisions are considered as proposed. The proposed revised concentration is presented in brackets

Reproduced from Part 5 of The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Direction 2010 and Directive 2013/39/EU

Table 6: Category 4 Screening Levels (C4SL) – Table taken from SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document (Department for Environment, Food and Rural Affairs December 2014)

	Residential (with home-grown produce)	Residential (without home-grown produce)	Allotments	Commercial	Public Open Space 1	Public Open Space 2
Arsenic	37	40	49	640	79	170
Benzene	0.87	3.3	0.18	98	140	230
Benzo(a)pyrene	5.0	5.3	5.7	77	10	21
Cadmium	22	150	3.9	410	220	880
Chromium VI	21	21	170	49	21	250
Lead	200	310	80	2300	630	1300

All in mg/kg
Public Open Space 1 – for grassed area adjacent to residential housing
Public Open Space 2 - Park Type Public Open Space Scenario

Table 7: Suitable 4 Use Levels (S4UL) - units are mg/kg Dry Weight

Determinand	Allotment	$R_{\underline{W}}HP$	$R_{\underline{WO}}HP$	Commercial/ Industrial	POSresi	POSpark
Metals						
Arsenic (**Inorganic**)[a, b, c]	43	37	40	640	79	170
Beryllium [a, b, d, e]	35	1.7	1.7	12	2.2	63
Boron [a, b, d]	45	290	11000	240000	21000	46000
Cadmium (**pH6-8**) [a, b, d, f]	1.9	11	85	190	120	560
Chromium (trivalent) [a, b, d, g]	18000	910	910	8600	1500	33000
Chromium (hexavalent) [a, b, c]	1.8[h]	6[i]	6[i]	33[i]	7.7[i]	220[i]
Copper [a, b, c]	520	2400	7100	68000	12000	44000
Mercury (elemental) [a, b, c, j]	21	1.2	1.2	58[vap] (25.8)	16	30[vap] (25.8)
Mercury (inorganic) [a, b, c]	19	40	56	1100	120	240
Methylmercury [a, b, c]	6	11	15	320	40	68
Nickel [a, b, c]	230[k]	180[e]	180[e]	980[e]	230[e]	3400[k]
Selenium [a, b, c]	88	250	430	12000	1100	1800
Vanadium [a, b, c, i, j]	91	410	1200	9000	2000	5000
Zinc [a, b, c]	620	3700	40000	730000	81000	170000
BTEX Compounds (SOM 1%/ 2.5%/ 6%)						
Benzene [a, b, l, m]	0.017/0.034/ 0.075	0.087/0.17/ 0.37	0.38/0.7/1.4	27 / 47 / 90	72 / 72 / 73	90 / 100 / 110
Toluene [a, b, l, m]	22 / 51 / 120	130 / 290 / 660	800[vap] (869) /1900/3900	56000[vap] (869) / 110000[vap] 1920)/ 180000[vap] (4360)	56000 / 56000 / 56000	87000[vap](869)/ 95000[vap](1920)/ 100000[vap](4360)
Ethylbenzene [a, b, l, m]	16 / 39 / 91	47 / 110 / 260	83 / 190 / 440	5700[vap] (518) / 13000[vap] (1220) / 27000[vap] (2840)	24000 / 24000 / 25000	17000[vap] (518) / 22000[vap](1220) / 27000[vap] (2840)
O – Xylene [a, b, l, m, n]	28 / 67 / 160	60 / 140 / 330	88 / 210 / 480	6600[sol] (478) / 15000[sol] (1120) / 33000[sol] (2620)	41000 / 42000 / 43000	17000[sol] (478) / 24000[sol] (1120) / 33000[sol] (2620)
M – Xylene [a, b, l, m, n]	31 / 74 / 170	59 / 140 / 320	82 / 190 / 450	6200[vap] (625) / 14000[vap] (1470) / 31000[vap] (3460)	41000 / 42000 / 43000	17000[vap] (625) / 24000[vap](1470) / 32000[vap] (3460)
P – Xylene [a, b, l, m, n]	29 / 69 / 160	56 / 130 / 310	79 / 180 / 430	5900[sol] (576) / 14000[sol] (1350) / 30000[sol] (3170)	41000 / 42000 / 43000	17000[sol] (576) / 23000[sol] (1350) / 31000[sol] (3170)
Polycyclic Aromatic Hydrocarbons (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
Acenaphthene	34 / 85 / 200	210 / 510 / 1100	3000[sol](57.0)/ 4700[sol] (141)/ 6000[sol] (336)	84000[sol] (57.0)/ 97000[sol] (141)/ 100000	15000 / 15000 / 15000	29000/ 30000/ 30000
Acenaphthylene	28 / 69 / 160	170 / 420 / 920	2900[sol](86.1)/ 4600[sol] (212)/ 6000[sol] (506)	83000[sol] (86.1)/ 97000[sol] (212)/ 100000	15000 / 15000 / 15000	29000 / 30000 / 30000
Anthracene	380 / 950 / 2200	2400 / 5400 / 11000	31000[sol](1.17 /35000/ 37000	520000/ 540000/ 540000	74000 / 74000 / 74000	150000 / 150000 / 150000
Benz(a)anthracene	2.9 / 6.5 / 13	7.2 / 11 / 13	11 / 14 / 15	170 / 170 / 180	29 / 29 / 29	49 / 56 / 62
Benzo(a)pyrene (Bap)	0.97 / 2.0 / 3.5	2.2 / 2.7 / 3.0	3.2 / 3.2 / 3.2	35 / 35 / 36	5.7/ 5.7/5.7	11 / 12 / 13
Benzo(b)fluoranthene	0.99 / 2.1 / 3.9	2.6 / 3.3 / 3.7	3.9 / 4.0 / 4.0	44 / 44 / 45	7.1/7.2/7.2	13 / 15 / 16
Benzo(g,h,i)perylene	290 / 470 / 640	320 / 340 / 350	360/360 / 360	3900/4000/ 4000	640/640/640	1400/1500/ 1600
Benzo(k)fluoranthene	37 / 75 / 130	77 / 93 / 100	110/ 110 / 110	1200/ 1200/1200	190/190/190	370 / 410 / 440
Chrysene	4.1 / 9.4 / 19	15 / 22 / 27	30 / 31 / 32	350 / 350 / 350	57 / 57 / 57	93 / 110 / 120
Dibenzo(ah)anthracene	0.14 / 0.27 / 0.43	0.24 / 0.28 / 0.3	0.31/0.32/ 0.32	3.5 / 3.6 / 3.6	0.57/0.57/0.58	1.1 / 1.3 / 1.4
Fluoranthene	52 / 130 / 290	280 / 560 / 890	1500/1600/ 1600	23000/23000/ 23000	3100/3100/ 3100	6300 / 6300 / 6400
Fluorene	27 / 67 / 160	170 / 400 / 860	2800[sol] (30.9) /3800[sol] (76.5) /4500[sol] (183)	63000[sol] (30.9) / 68000 / 71000	9900 / 9900 / 9900	20000 / 20000 / 20000
Indeno(1,2,3-cd)pyrene	9.5 / 21 / 39	27 / 36 / 41	45 / 46 / 46	500 / 510 / 510	82 / 82 / 82	150 / 170 / 180
Naphthalene [q]	4.1 / 10 / 24	2.3 / 5.6 / 13	2.3 / 5.6 / 13	190[sol] (76.4) / 460[sol] (183) / 1100[sol] (432)	4900/ 4900/ 4900	1200[sol] (76.4) / 1900[sol] (183) / 3000
Phenanthrene	15 / 38 / 90	95 / 220 / 440	1300[sol](36.0)/ 1500/1500	22000 / 22000 / 23000	3100 / 3100 / 3100	6200 / 6200 / 6300
Pyrene	110 / 270 / 620	620 / 1200 / 2000	3700 / 3800 / 3800	54000 / 54000 / 54000	7400 / 7400 / 7400	15000 / 15000 / 15000
Coal Tar (Bap as surrogate marker)	0.32 / 0.67 / 1.2	0.79 / 0.98 / 1.1	1.2 / 1.2 / 1.2	15 / 15 / 15	2.2 / 2.2 / 2.2	4.4 / 4.7 / 4.8
Explosives [a, b, l, p]						
2, 4, 6 Trinitrotoluene	0.24 / 0.58 / 1.40	1.6 / 3.7 / 8.0	65 / 66 / 66	1000/1000/1000	130/130 / 130	260 / 270 / 270
RDX (Royal Demolition Explosive $C_3H_6N_6O_6$)	17 / 38 / 85	120 / 250 / 540	13000 / 13000 / 13000	210000 / 210000 / 210000	26000/26000/ 27000	49000[sol] (18.7) / 51000 / 53000
HMX (High Melting Explosive $C_4H_8N_8O_8$)	0.86 / 1.9 / 3.9	5.7 / 13 / 26	6700 / 6700 / 6700	110000 / 110000 / 110000	13000 / 13000 / 13000	23000[vap] (0.35) /23000[vap] (0.39) /24000[vap] (0.48)

Determinand	Allotment	R_WHP	R_{WO}HP	Commercial/ Industrial	POSresi	POSpark
Petroleum Hydrocarbons (SOM 1%/ 2.5%/ 6%) [a, b, l, m]						
Aliphatic EC 5-6	730 / 1700 / 3900	42 / 78 / 160	42 / 78 / 160	3200[sol] (304) / 5900[sol] (558) / 12000[sol] (1150)	570000[sol](304 590000 / 600000	95000[sol] (304) / 130000[sol] (558)/ 180000[sol](1150)
Aliphatic EC >6-8	2300 / 5600 / 13000	100 / 230 / 530	100 / 230 / 530	7800[sol] (144) / 17000[sol] (322) / 40000[sol] (736)	600000 / 610000 / 620000	150000[sol] (144) 220000[sol] (322)/ 320000[sol] (736)
Aliphatic EC >8-10	320 / 770 / 1700	27 / 65 / 150	27 / 65 / 150	2000[sol] (78) / 4800[vap] (190) / 11000[vap] (451)	13000 / 13000 / 13000	14000[sol] (78) / 18000[vap] (190) / 21000[vap] (451)
Aliphatic EC >10-12	2200 / 4400 / 7300	130v[ap] (48) / 330[vap] (118) / 760[vap] (283)	130v[ap] (48) / 330[vap] (118) / 770[vap] (283)	9700[sol] (48) / 23000[vap] (118) / 47000[vap] (283)	13000 / 13000 / 13000	21000[sol] (48) / 23000[vap] (118) / 24000[vap] (283)
Aliphatic EC >12-16	11000 / 13000 / 13000	1100[sol] (24) / 2400[sol] (59) / 4300[sol] (142)	1100[sol] (24) / 2400[sol] (59) / 4400[sol] (142)	59000[sol] (24) / 82000[sol] (59) / 90000[sol] (142)	13000 / 13000 / 13000	25000[sol] (24) / 25000[sol] (59) / 26000[sol] (142)
Aliphatic EC >16-35 °	260000 / 270000 / 270000	65000[sol](8.48 92000[sol] (21) 110000	65000[sol](8.48 92000[sol] (21) 110000	1600000 / 1700000 / 1800000	250000 / 250000 / 250000	450000 / 480000 / 490000
Aliphatic EC >35-44 °	260000 / 270000 / 270000	65000[sol](8.48 92000[sol] (21) / 110000	65000[sol](8.48 92000[sol] (21) 110000	1600000 / 1700000 / 1800000	250000 / 250000 / 250000	450000 / 480000 / 490000
Aromatic EC 5-7 (benzene)	13 / 27 / 57	70 / 140 / 300	370 / 690 / 1400	260000[sol] (1220) / 46000[sol] (2260) / 86000[sol] (4710)	56000 / 56000 / 56000	76000[sol](1220) /84000[sol](2260)/ 92000[sol] (4710)
Aromatic EC >7-8 (toluene)	22 / 51 / 120	130 / 290 / 660	860 / 1800 / 3900	56000[vap] (869)/ 110000[sol] (1920)/ 180000[vap] (4360)	56000 / 56000 / 56000	87000[vap](869) / 95000[sol] (1920)/ 100000[vap](4360)
Aromatic EC >8-10	8.6 / 21 / 51	34 / 83 / 190	47 / 110 / 270	3500[vap] (613) / 8100[vap] (1500) / 17000[vap] (3580)	5000 / 5000 / 5000	7200[vap](613) / 8500[vap] (1500) / 9300[vap] (3580)
Aromatic EC >10-12	13 / 31 / 74	74 / 180 / 380	250 / 590 / 1200	16000[sol] (364) / 28000[sol] (899) / 34000[sol] (2150)	5000 / 5000 / 5000	9200[sol] (364) / 97000[sol] (899) / 10000
Aromatic EC >12-16	23 / 57 / 130	140 / 330 / 660	1800 / 2300[sol] (419) / 2500	36000[sol] (169) / 37000 / 38000	5100 / 5100 / 5000	10000 / 10000 / 10000
Aromatic EC >16-21 °	46 / 110 / 260	260 / 540 / 930	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7600 / 7700 / 7800
Aromatic EC >21-35 °	370 / 820 / 1600	1100 / 1500 / 1700	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Aromatic EC >35-44 °	370 / 820 / 1600	1100 / 1500 / 1700	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Aliphatic+Aromatic EC >44-70 °	1200 / 2100 / 3000	1600 / 1800 / 1900	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Chloroalkanes & Chloroalkenes (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
1,2-Dichloroethane	0.0046 / 0.0083 / 0.016	0.0071 / 0.011 / 0.019	0.092 / 0.013 / 0.023	0.67 / 0.97 / 1.7	29 / 29 / 29	21 / 24 / 28
1,1,1 Trichloroethane (TCA)	48 / 110 / 240	8.8 / 18 / 39	9.0 / 18 / 40	660 / 1300 / 3000	140000 / 140000 / 140000	57000[vap](1425) 76000[vap](2915)/ 100000[vap](6392
1,1,1,2 Tetrachloroethane	0.79 / 1.9 / 4.4	1.2 / 2.8 / 6.4	1.5 / 3.5 / 8.2	110 / 250 / 560	1400 / 1400 / 1400	1500 / 1800 / 2100
1,1,2,2 Tetrachloroethane	0.41 / 0.89 / 2.0	1.6 / 3.4 / 7.5	3.9 / 8.0 / 17	270 / 550 / 1100	1400 / 1400 / 1400	1800 / 2100 / 2300
Tetrachloroethene (PCE)	0.65 / 1.5 / 3.6	0.18 / 0.39 / 0.90	0.18 / 0.4 / 0.92	19 / 42 / 95	1400 / 1400 / 1400	810[sol](424)/1100 [sol] (951)/1500
Tetrachloromethane (Carbon Tetrachloride)	0.45 / 1.0 / 2.4	0.026 / 0.056 / 0.13	0.026 / 0.056 / 0.13	2.9 / 6.3 / 14	890 / 920 / 950	190 / 270 / 400
Trichloroethene (TCE)	0.041 / 0.091 / 0.21	0.016 / 0.034 / 0.075	0.017 / 0.036 / 0.080	1.2 / 2.6 / 5.7	120 / 120 / 120	70 / 91 / 120
Trichloromethane (Chloroform)	0.42 / 0.83 / 1.7	0.91 / 1.7 / 3.4	1.2 / 2.1 / 4.2	99 / 170 / 350	2500 / 2500 / 2500	2600 / 2800 / 3100
Chloroethene (Vinyl Chloride)	0.00055/ 0.001/ 0.0018	0.00064 / 0.00087/ 0.0014	0.00077 / 0.001 / 0.0015	0.059 / 0.077 / 0.12	3.5 / 3.5 / 3.5	4.8 / 5.0 / 5.4
Phenol & Chlorophenols [a, b, l, p]						
Phenol	23 /42 / 83	120 / 200/380	440/690 /1200	440[dir] (26000) / 690[dir] (30000) / 1300[dir] (34000)	440[dir] (10000)/ 690[dir](10000) 1300[dir](10000)	440[dir] (7600) / 690[dir] (8300) / 1300[dir] (93000)
Chlorophenols (excluding PCP) [r]	0.13[s] / 0.3 / 0.7	0.87[s] / 2.0 / 4.5	94 / 150 / 210	3500 / 4000 / 4300	620/ 620 / 620	1100/1100/ 1100
Pentachlorophenol (PCP)	0.03 / 0.08 / 0.19	0.22/ 0.52 / 1.2	27[vap] (16.4) / 29 / 31	400 / 400 / 400	60 / 60 / 60	110 / 120 / 120
Other [a, b, l, p]						
Carbon Disulphide	4.8 / 10 / 23	0.14/0.29 /0.62	0.14/0.29 /0.62	11 / 22 / 47	11000 / 11000 / 12000	1300 / 1900 / 2700
Hexachlorobutadiene (HCBD)	0.25/0.61/1.4	0.29/0.7/1.6	0.32/0.78/1.8	31 / 66 / 120	25 / 25 / 25	48 / 50 / 51

Determinand	Allotment	R_WHP	R_{WO}HP	Commercial/ Industrial	POSresi	POSpark
Pesticides (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
Aldrin	3.2 / 6.1 / 9.6	5.7/ 6.6 /7.1	7.3 / 7.4 / 7.5	170 / 170 / 170	18 / 18 / 18	30 / 31 / 31
Atrazine	0.5 / 1.2 / 2.7	3.3/7.6/17.4	610/ 620 / 620	9300 / 9400 / 9400	1200/1200 /1200	2300 / 2400 / 2400
Dichlorvos	0.0049/0.010/ 0.022	0.032/0.066/ 0.14	6.4 / 6.5 / 6.6	140 / 140 / 140	16 / 16 / 16	26 / 26 / 27
Dieldrin	0.17/0.41/0.96	0.97/ 2 / 3.5	7.0 / 7.3 / 7.4	170 / 170 / 170	18 / 18 / 18	30 / 30 / 31
Alpha - Endosulfan	1.2 / 2.9 / 6.8	7.4 / 18 / 41	160^{vap} (0.003)/ 280^{vap} (0.007)/ 410^{vap} (0.016)	5600^{vap} (0.003) / 7400^{vap} (0.007) / 8400^{vap} (0.016)	1200 / 1200 / 1200	2400 / 2400 / 2500
Beta - Endosulfan	1.1 / 2.7 / 6.4	7.0 / 17 / 39	190^{vap}(0.00007) /320^{vap}(0.0002) /440^{vap}(0.0004)	6300^{vap}(0.00007) /7800^{vap}(0.0002) / 8700	1200 / 1200 / 1200	2400 / 2400 / 2500
Alpha-Hexachlorocyclohexane	0.035/0.087/ 0.21	0.23/0.55 / 1.2	6.9 / 9.2 / 11	170 / 180 / 180	24 / 24 / 24	47 / 48 / 48
Beta - Hexachlorocyclohexane	0.013/0.032/ 0.077	0.085 / 0.2/ 0.46	3.7 / 3.8 / 3.8	65 / 65 / 65	8.1 / 8.1 / 8.1	15 / 15 / 16
Gamma – Hexachlorocyclohexane	0.0092 / 0.023 / 0.054	0.06/0.14/ 0.33	2.9 / 3.3 / 3.5	67 / 69 / 70	8.2 / 8.2 / 8.2	14 / 15 / 15
Chlorobenzenes [a, b, l, p]						
Chlorobenzene	5.9 / 14 / 32	0.46 / 1.0 / 2.4	0.46 / 1.0 / 2.4	56 / 130 / 290	11000 / 13000 / 14000	1300^{sol}(675)/ 2000^{sol}(1520)/ 2900
1,2-dichlorobenzene (1,2-DCB)	94 / 230 / 540	23 / 55 / 130	24 / 57 / 130	2000^{sol} (571) / 4800^{sol} (1370) / 11000^{sol} (3240)	90000 / 95000 / 98000	24000^{sol} (571) / 36000^{sol} (1370) /51000^{sol} (3240)
1,3-dichlorobenzene (1,3-DCB)	0.25 / 0.6 / 1.5	0.4 / 1.0 / 2.3	0.44/1.1 / 2.5	30 / 73 / 170	300/ 300 / 300	390 / 440 / 470
1-4-dichlorobenzene (1,4-DCB)	15^{i} / 37^{i} / 88 ^{i}	61^{q} / 150^{q} /350 ^{q}	61^{q}/150^{q}/350^{q}	4400^{vap,q} (224) / 10000^{vap,q} (540) / 25000^{vap,q} (1280)	17000^{i} / 17000^{i} / 17000^{i}	36000^{vap,i} (224) 36000$^{vap,\ i}$(540)/ 36000^{vap,i}(1280)
1,2,3-Trichlorobenzene	4.7 / 12 / 28	1.5 / 3.6 / 8.6	1.5 / 3.7 / 8.8	102 / 250 / 590	1800 / 1800 / 1800	770^{vap} (134) / 1100^{vap} (330) / 1600^{vap} (789)
1,2,4- Trichlorobenzene	55 / 140 / 320	2.6 / 6.4 / 15	2.6 / 6.4 / 15	220 / 530 / 1300	15000 / 17000 / 19000	1700^{vap} (318) / 2600^{vap} (786) / 4000^{vap} (1880)
1,3,5- Trichlorobenzene	4.7 / 12 / 28	0.33 / 0.81 / 1.9	0.33 / 0.81 / 1.9	23 / 55 / 130	1700 / 1700 / 1800	380^{vap} (36.7) / 580^{vap} (90.8) / 860^{vap} (217)
1,2,3,4-Tetrachlorobenzene	4.4 / 11 / 26	15 / 36 / 78	24 / 56 / 120	1700^{vap} (122) / 3080^{vap} (304) / 4400^{vap} (728)	830 / 830 / 830	1500^{vap} (122) / 1600 / 1600
1,2,3,5- Tetrachlorobenzene	0.38 / 0.90 / 2.2	0.66 / 1.6 / 3.7	0.75 / 1.9 / 4.3	49^{vap} (39.4) / 120^{vap} (98.1) / 240^{vap} (235)	78 / 79 / 79	110^{vap} (39) / 120 / 130
1,2,4,5- Tetrachlorobenzene	0.06 / 0.16 / 0.37	0.33 / 0.77 / 1.6	0.73 / 1.7 / 3.5	42^{sol} (19.7) / 72^{sol} (49.1) / 96	13 / 13 / 13	25 / 26 / 26
Pentachlorobenzene (P_ECB)	1.2 / 3.1 / 7.0	5.8 / 12 / 22	19 / 30 / 38	640^{sol} (43.0) / 770^{sol} (107) / 830	100 / 100 / 100	190 / 190 / 190
Hexachlorobenzene (HCB)	0.47 / 1.1 / 2.5	1.8^{vap} (0.20) / 3.3^{vap} (0.5) / 4.9	4.1^{vap} (0.20) / 5.7^{vap} (0.5) / 6.7^{vap} (1.2)	110^{vap} (0.20) / 120 / 120	16 / 16 / 16	30 / 30 / 30

R_WHP Residential with homegrown produce
R_{WO}HP Residential without homegrown produce
POSresi public open spaces near residential housing
POSpark public open space for recreational use but not dedicated sports pitches
SOM Soil Organic Matter – ***the S4UL for all organic compounds will vary according to SOM***

a Based on a sandy loam soil as defined in SR3 (Environment Agency, 2009b) and 6% soil organic matter (SOM)
b Figures rounded to two significant figures
c Based only on a comparison of oral and dermal soil exposure with oral Index Dose
d The background ADE is limited to being no larger than the contribution from the relevant soil ADE
e Based on comparison of inhalation exposure with inhalation TDI only
f Based on a lifetime exposure via the oral, dermal and inhalation pathways
g Based on localised effects comparing inhalation exposure with inhalation ID only
h Based on comparison of inhalation exposure with inhalation ID
i Based on comparison of oral and dermal exposure with oral TDI
j Based on comparison of oral, dermal and inhalation exposure with inhalation TDI
k Based on comparison of all exposure pathways with oral TDI
l S4ULs assume that free phase contamination is not present
m S4ULs based on a sub-surface soil to indoor air correction factor of 10
n The HCV applied is based on the intake of total Xylene and therefore exposure should not consider an isomer in isolation
o Oral, dermal and inhalation exposure compared with oral HCV
p S4ULs based on a sub-surface soil to indoor air correction factor of 1
q Based on a comparison of inhalation exposure with the inhalation TDI for localised effects
r Based on 2,4-dichlorophenol unless otherwise stated
s Based on 2,3,4,6-tetrachlorophenol
vap S4UL presented exceeded the vapour saturation limit, which is presented in brackets
sol S4UL presented exceeds the solubility saturation limit, which is presented in brackets
dir S4ULs based on a threshold protective of direct skin contact, guideline in brackets based on the health effects following long term exposure provided for illustration only

Appendix C: Flocculent Safety Data Sheet

Safety Data Sheet according to WHS and ADG requirements

Issue Date: 24/05/2020
Print Date: 24/05/2020

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

Product Identifier

Product name	**BoEnzymes FLOCCULANT**
Chemical Name	**Mixture blended from discrete components – not applicable**
Synonyms	**FLOCCULANT**
Chemical Formula	**Mixture blended from discrete components – not applicable**
Other Means of Identification	**Not Available**
CAS Number	**Mixture blended from discrete components – not applicable**

Relevant identified uses of the substance or mixture and uses advised against

Relevant Identified Uses	**COAGGULANT / FLOCULLANT FOR WATER TREATMENT**

Details of the supplier of the safety data sheet

Registered Company Name	**BioEnzymes Pty Ltd**
Address	**Unit 1C 424 BILSEN RD, GEEBUNG BRISBANE QLD 4034**
Telephone	**0410 797 713 07 3630 4683**
FAX	**NA**
Website	**www.bioenzymes.com.au**
Email	**james@bioenzymes.com.au**

Emergency telephone number

Organisation	**Chemical Consulting Services Pty Ltd**
Emergency Contact Number	**0417720832**
Other Emergency Numbers	**13 11 26 (Poisons Information Centre Hotline)**

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

HAZARDOUS CHEMICAL. NON-DANGEROUS GOODS. According to the WHS Regulations and the ADG Code.

HAZARD RATING

POISONS SCHEDULE	not scheduled
CLASSIFICATION	Skin Corrosion/Irritation Category 2 Eye Irritation Category 2A

Label elements

GHS LABEL ELEMENTS

SIGNAL WORD **WARNING**

Hazard statement(s)

H315 **Causes skin irritation.**
H319 **Causes serious eye irritation**

Precautionary statement(s) Prevention

P271 **Use only outdoors or in a well-ventilated area.**
P261 **Avoid breathing dust/fumes.**
P280 **Wear protective gloves/protective clothing/eye protection/face protection**

Precautionary statement(s) Response

P362 **Take off contaminated clothing and wash before reuse.**
P305+P351+P338 **IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.**
P312 **Call a POISON CENTER or doctor/physician if you feel unwell.**
P337+P313 **If eye irritation persists: Get medical advice/attention.**
P302+P352 **IF ON SKIN: Wash with plenty of soap and water.**
P304+P340 **IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.**
P332+P313 **If skin irritation occurs: Get medical advice/attention**

Precautionary statement(s) Storage

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

Precautionary statement(s) Disposal

P501 **Dispose of contents/container in accordance with local regulations.**

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

CAS #	% w/w	NAME
12042-91-0	30 - 60	aluminium chlorohydrate
	To 100%	Other ingredients determined not to be hazardous

Mixtures

See section above for composition of Substances

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact
If this product comes in contact with the eyes:
Wash out immediately with fresh running water.
Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
Seek medical attention without delay; if pain persists or recurs seek medical attention.
Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact
If skin contact occurs:
Immediately remove all contaminated clothing, including footwear.
Flush skin and hair with running water (and soap if available).
Seek medical attention in event of irritation.

Inhalation
If fumes, aerosols or combustion products are inhaled remove from contaminated area.
Other measures are usually unnecessary.

Ingestion
If swallowed do NOT induce vomiting.
If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
Observe the patient carefully.
Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
Seek medical advice.

Indication of any immediate medical attention and special treatment needed

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

There is no restriction on the type of extinguisher which may be used. Use extinguishing media suitable for surrounding area.

Special hazards arising from the substrate or mixture

Fire Incompatibility Avoid reaction with strong acids and strong alkalis

Advice for firefighters

Fire Fighting

Alert Fire Brigade and tell them location and nature of hazard.
Wear breathing apparatus plus protective gloves in the event of a fire.
Prevent, by any means available, spillage from entering drains or water courses.
Use fire fighting procedures suitable for surrounding area.
DO NOT approach containers suspected to be hot.
Cool fire exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

Non combustible.
Not considered a significant fire risk, however containers may burn.
Combustion products may produce fumes of: hydrochloric acid

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Minor Spills

Clean up all spills immediately.
Avoid contact with skin and eyes.
Control personal contact with the substance, by using protective equipment.
Use dry clean up procedures and avoid generating dust.
Place in a suitable, labelled container for waste disposal.

Major Spills

CAUTION: Advise personnel in area.
Alert Emergency Services and tell them location and nature of hazard.
Control personal contact by wearing protective clothing.
Prevent, by any means available, spillage from entering drains or water courses.
Recover product wherever possible.
IF DRY: Use dry clean up procedures and avoid generating dust. Collect residues and place in sealed plastic bags or other containers for disposal.
IF WET: Vacuum/shovel up and place in labelled containers for disposal.
ALWAYS: Wash area down with large amounts of water and prevent runoff into drains.
If contamination of drains or waterways occurs, advise Emergency Services.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
DO NOT allow material to contact humans, exposed food or food utensils.
Avoid contact with incompatible materials.
When handling, **DO NOT** eat, drink or smoke.
Keep containers securely sealed when not in use.
Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately. Launder contaminated clothing before re-use.
Use good occupational work practice.
Observe manufacturer's storage and handling recommendations contained within this SDS.
Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Store in original containers.
Keep containers securely sealed.
Store in a cool, dry, well-ventilated area.
Store away from incompatible materials and foodstuff containers.
Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storage and handling recommendations contained within this SDS.

Conditions for safe storage, including any incompatibilities

Suitable container

Polyethylene or polypropylene container.
Packing as recommended by manufacturer.
Check all containers are clearly labelled and free from leaks.

Storage incompatibility
Segregate from strong acids and alkalis.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	aluminium chlorohydrate	Aluminium, soluble salts (as Al)	2 mg/m3	Not Available	Not Available	Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
PolyAluminium Chloride)		Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
aluminium chlorohydrate	Not Available	Not Available

Exposure controls

Appropriate engineering controls

Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.

The basic types of engineering controls are:

Process controls which involve changing the way a job activity or process is done to reduce the risk.
Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use.

Employers may need to use multiple types of controls to prevent employee overexposure.

Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.

If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered.
Such protection might consist of:

(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks.

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Personal protection

Safety glasses with side shields. Chemical goggles.
Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent]

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).
When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended. When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended. Some glove polymer types are less affected by movement and this should be taken into account when considering gloves for long-term use. Contaminated gloves should be replaced. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended. Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present. polychloroprene. nitrile rubber.butyl rubber. fluorocaoutchouc. polyvinyl chloride. Gloves should be examined for wear and/ or degradation constantly.

Other protection
Overalls.
P.V.C. apron.
Barrier cream.
Skin cleansing cream.
Eye wash unit.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance

Off white viscous liquid

Physical state	Liquid	Relative Density (Water = 1)	1.3
Odour	Bland	Partition co-efficient n-octanol / water	Not Available
Odour Threshold	Not Available	Autoignition Temperature	Not Available
pH (as supplied)	3.8 – 4.2 typical	Decomposition Temperature	Not Available
Melting Point / Freezing Point (°C)	Not Applicable	Viscosity	Not Determined
Initial Boiling point and boiling range (°C)	Not Applicable	Molecular Weight	Not Applicable
Flash Point (°C)	Not Applicable	Taste	Not Applicable
Evaporation Rate	Not Applicable	Explosive Properties	Not Applicable
Flammability	Not Flammable	Oxidizing Properties	Not Applicable
Upper Explosive Limit (UEL %)	Not Applicable	Surface Tension (mN/m)	Not Applicable
Lower Explosive Limit (LEL %)	Not Applicable	Volatile Component	Not Applicable
Vapour pressure (kPa)	Not Applicable	Gas Group	Not Applicable
Solubility in water (g/L)	Miscible	pH as a solution (1%)	4.5 - 5 @ 25°C
Vapour density (Air = 1)	Not Applicable	VOC g/L	Not Applicable

SECTION 10 STABILITY AND REACTIVITY

Reactivity See section 7

Chemical stability Unstable in the presence of incompatible materials.
Product is considered stable.
Hazardous polymerisation will not occur.

Possibility of hazardous reactions See section 7

Conditions to avoid See section 7

Incompatible materials See section 7

Hazardous decomposition products See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled **This is not anticipated to be an issue under normal conditions of use.**
The material is not thought to produce adverse health effects or irritation of the respiratory tract (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.
Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.
If prior damage to the circulatory or nervous systems has occurred or if kidney damage has been sustained, proper screenings should be conducted on individuals who may be exposed to further risk if handling and use of the material result in excessive exposures.

Ingestion **This is not anticipated to be an issue under normal conditions of use.**

Ingestion may result in nausea, abdominal irritation The material is moderately discomforting to the gastro-intestinal tract and may be harmful if swallowed in large quantity Considered an unlikely route of entry in commercial/industrial environments

Skin Contact

The material may produce mild skin irritation in sensitive individuals
Open cuts, abraded or irritated skin should not be exposed to this material

Eye

Evidence exists, or practical experience predicts, that the material may cause mild eye irritation.

Chronic

Reference Data

Accute Toxicity Data

Aluminium Chlorohydrate	***TOXICITY***	***IRRITATION***
	dermal (rat) LD50: >2000 mg/kg[1]	***Skin (human): 150 mg/30 s - mild***
	Oral (rat) LD50: >2000 mg/kg[1]	

Legend: *1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

SECTION 12 ECOLOGICAL INFORMATION

Ingredient	Endpoint	Test Duration (hr)	Species	Value	Source
aluminium chlorohydrate	LC50	96	Fish	1mg/L	2
aluminium chlorohydrate	EC50	48	Crustacea	0.214-1.26mg/L	2
aluminium chlorohydrate	EC50	72	Algae or other aquatic plants	0.075mg/L	2
aluminium chlorohydrate	EC50	48	Algae or other aquatic plants	0.014mg/L	2
aluminium chlorohydrate	NOEC	1440	Fish	0.013mg/L	2

Legend:

Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:

Reduction
Reuse
Recycling
Disposal (if all else fails)
This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning or process equipment to enter drains.
It may be necessary to collect all wash water for treatment before disposal.
In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
Where in doubt contact the responsible authority.
Recycle wherever possible.
Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or incineration in a licenced apparatus (after admixture with suitable combustible material).
Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant NO

HAZCHEM Not Applicable

Land transport (ADG): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

SECTION 15 REGULATORY INFORMATION

ALUMINIUM CHLOROHYDRATE(12042-91-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS
Australia Exposure Standards
Australia Hazardous Substances Information System - Consolidated Lists
Australia Inventory of Chemical Substances (AICS)

SECTION 16 OTHER INFORMATION

Other information

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

Definitions and abbreviations
PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index