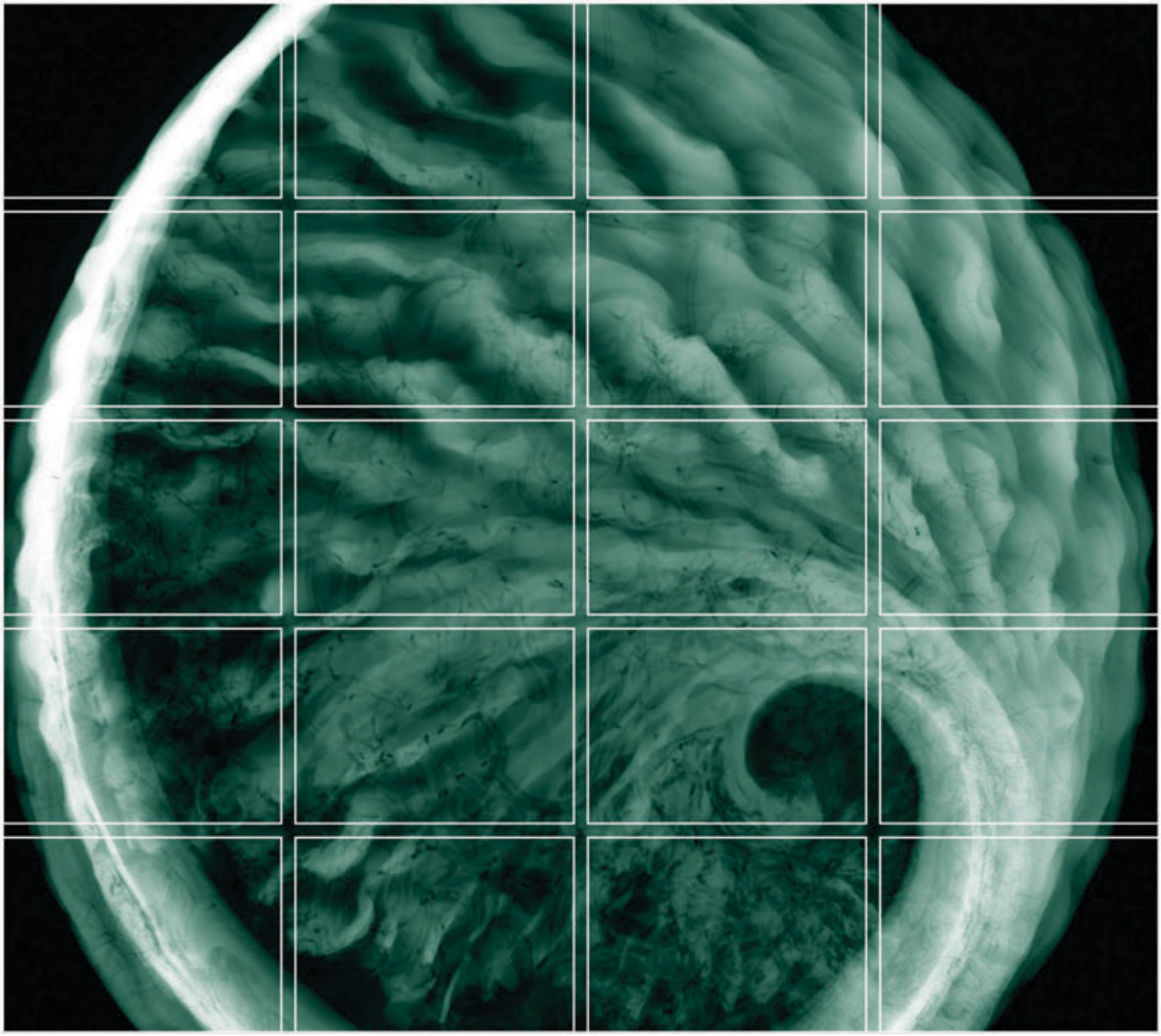

Road Stabilisation and Dust Suppression Chemical Ecological Risk Assessment

Technical Report

Global Road Technology

15 May 2014

0222833_RP01 Final

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Road Stabilisation and Dust Suppression Chemical Ecological Risk Assessment

Technical Report

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Environmental Resources Management Australia Pty Ltd Quality System

Global Road Technology

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EXECUTIVE SUMMARY

Environmental Resources Management Australia Pty Ltd (ERM) was commissioned by Global Road Technology (GRT) to assess the potential ecological risks and risks to livestock health associated with the use of GRT7000, GRT8000 and GRT9000 for dust suppression on roadways in Queensland.

The main ingredients in these products are bitumen, hybrid-styrene copolymer, and an emulsifier. The assessment considered the potential risk to the aquatic environment resulting from spillages and run-off / leaching from treated roads, and potential risk to livestock health resulting from grazing adjacent to treated roads. The potential for creation of soil contamination via leaching, effects on meat quality, and risk to organic certification were also evaluated.

The assessment included ecotoxicity testing of the products and of leachate from soils treated with typical application solutions of the products. The soil leachate was also chemically analysed.

Toxicity tests were conducted on five test species (Ceriodaphnia cf dubia, microalgae, aquatic duckweed, freshwater shrimp, and rainbow fish). The 48-hr Ceriodaphnia cf dubia acute toxicity test was the most sensitive test, followed by the 72-hr microalgal growth inhibition test. The NOECs for the remaining three tests were greater than the maximum test concentration of 1000 mg/L. The soil leachate for GRT7000 and GRT8000/GRT9000 had significantly lower toxicity than products themselves.

Ecological Risk-based screening levels (RBSLs) were calculated for GRT7000 and GRT8000/GRT9000 using the Burr Type III statistical distribution (BT III SD) method (ANZECC and ARMCANZ, 2000). The Ecological RBSLs were 12.1 mg/L and 110 mg/L for GRT7000 and GRT8000/GRT9000 respectively. The dilution factor required to achieve a "no effect" concentration was then calculated using the Ecological RBSLs. The required dilution factors applied to a direct spill of the application solutions, which are mixed at a 6:1 water: product ratio, were 11.8 and 1.3 times for GRT7000 and GRT8000/GRT9000 respectively.

*The event of a direct spillage into a water body of the *application solution of GRT 7000 or GRT8000/GRT9000 may result in potential harm to a water environment assuming the dilution within the receiving water body is less than the defined dilution factors (1.3 or 11.8). The dilution factors presented and the Ecological RBSLs above can be used for further site-specific assessment of spill events.*

The toxicity of the soil leachate was used qualitatively to consider the potential effects on aquatic receptors of run-off entering a waterbody. Soil leachates were less toxic than the products, and the dilution factor calculated for the application solution is therefore conservative for assessment of the run-off. The above levels of dilution for all three products are considered very likely to occur. The risk to aquatic receptors from treated roads via leaching and run-off is therefore considered low

ERM also developed soil ingestion risk based screening levels (Livestock RBSLs) which represent a concentration of each chemical in soil that is not likely to result in a risk to health of the cattle. Following the derivation of the soil ingestion Livestock RBSLs, the concentration of the stabilisation products in the roadway soils was calculated and compared with the Livestock RBSLs. This identified that there is no significant risk to cattle health from exposure to the products in a stabilised roadway.

*Please contact Global Road Technology

ERM also investigated the potential risks with respect to the beef cattle marketplace (e.g. Australian market, EU market or organic market) through a review of relevant government import/export and organic certification guidelines.

ERM found that the Australian Government have not assessed these products for export of cattle, however this is considered to be due to their low risk to export. As such, it is considered that use of these products on cattle farms will not result in market risks. However, ERM considers that there is a potential risk to organic certification if the products were used in field with current certification.

1 INTRODUCTION

1.1 COMMISSION

Environmental Resources Management Australia Pty Ltd (ERM) was commissioned by Global Road Technology (GRT) to assess the potential ecological risks associated with the use of GRT7000, GRT8000 and GRT9000 for dust suppression on roadways in Queensland.

1.2 PROJECT BACKGROUND

GRT manufactures products used in road stabilization and dust control in farming, mining, construction, and other industries. GRT products are diluted in water and applied to existing soil in the normal watering, grading, or profiling process.

GRT7000 is a bonding/capping agent, which consists of a non-ionising liquid polymer. GRT7000 concentrate is diluted with water. GRT8000 and GRT9000 are dust suppressants, consisting of biopolymers and surfactants. They are used for road stabilization and surfacing, creating a hard, semi-flexible, and water impermeable road surface, which prevents dust, pot holes, rutting, corrugation and other surface degradation caused by heavy traffic or extreme weather. GRT8000 and GRT9000 are very similar products and can be used interchangeably. They are referred to as GRT8000/GRT9000 in the report. The GRT products are diluted at a ratio of one to six with water.

This report focuses on the application of GRT7000 and GRT8000/GRT9000 to access roadways in Queensland. There is limited potential for leaching from the roadways once the products have polymerized; however, as with any liquid product, there is a potential for spills.

1.3 OBJECTIVES

The objectives of this report were to:

- review the use of the dust suppression/road stabilisation products GRT7000, GRT8000 and GRT9000 and identify the potential pathways via which the products may reach aquatic ecological receptors or livestock;
- evaluate the aquatic toxicity in accordance with the Australia and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) guidelines for fresh and marine water quality;

- evaluate the likely toxicity of the products and stabilised soils to cattle using published toxicity data; and

- estimate exposure to the products based on their intended use and assess the potential risks the aquatic environment and livestock that may be associated with this exposure.

1.4 SCOPE OF WORK

The scope of work included:

- scheduling chronic and acute ecotoxicological analysis for the product-stabilised soils and the raw product. Ecotoxicity testing was conducted for a suite of four aquatic species, including fish. It is noted that GRT has already provided the results of ecotoxicity testing using the freshwater cladoceran *Ceriodaphnia cf dubia* undertaken on aqueous dilutions of GRT7000 and GRT8000/9000 and on the leachate from soil samples stabilised with each product;

- evaluating the mobility of the chemical components of the products in the environment using the results of laboratory chemical analysis of the soil leachate. This analysis established the chemical concentrations in the soil leachate used for testing ecotoxicity[1];

- calculating the amount of product in the stabilised soil sample based on the GRT rate of application of product to soils. This was compared to the soil leachate analysis and used to indicate the extent to which the soil stabilisation process reduces the availability of the product in the environment following stabilisation;

- reviewing the MSDS for GRT7000, GRT8000 and GRT9000 for currency and compliance and evaluating the toxicity of the chemicals and any breakdown products to livestock using published toxicological data.;

- evaluating the aquatic toxicity of the products using the ecotoxicity testing results (including the results of the aquatic ecotoxicity tests provided by GRT);

[1] Note that ERM considers that the ecotoxicity test media provides a better guide to environmental leachability than a standard Toxicity Characteristic Leaching Procedure, which is designed to simulate the effects of municipal landfill leachate and not relevant to this assessment.

- reviewing the use of the dust suppression products and identifying the potential pathways via which the products may reach the aquatic environment. The potential risks of the products for aquatic organisms under a variety of plausible exposure scenarios were explained. The assessment does not provide quantitative prediction of exposure to aquatic environments, since this will be highly dependent on the actual site conditions, and we consider that a generic assessment will be able to be applied to multiple sites;

- using the ANZECC and ARMCANZ (2000) method to calculate a risk-based screening level (RBSL) for surface water protective of 95% of species. The RBSL will be used to calculate the level of dilution required to reach a "no effect" concentration; and

- preparing a report that will be suitable for presentation to stakeholders, including the DEHP, to allow understanding of the potential risks associated with the products.

2 APPROACH

Agriculture is the dominant land use in the area where GRT products are applied in Queensland. Potential ecological receptors of runoff from the roadways considered in this report include aquatic receptors and livestock. The assessment of risk to livestock focused on cattle.

The risk assessment was conducted in accordance with the following relevant Australian and international guidelines including:

- enHealth 2013. Environmental Health Risk Assessment. Department of Health and Ageing, Government of Australia, Canberra.
- ANZECC and ARMCANZ (2000) National Water Quality Management Strategy, Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
- API (2004) API 4733. Risk-Based Screening Levels for the Protection of Livestock Exposed to Petroleum Hydrocarbons.

This report used a risk-based approach with the following steps:

- Receptor Selection;
- Pathway Evaluation;
- Hazard Assessment;
- Exposure Assessment; and
- Risk Characterisation.

The specific approaches used for aquatic receptors and livestock are detailed below.

2.1 AQUATIC RECEPTORS

Receptor Selection

The aquatic receptors considered in this assessment were species that were considered representative of the different taxa that could be present in the water column in water holes or streams on farm properties. These include algae, zooplankton, and fish.

Pathway Evaluation

This assessment considered direct contact of aquatic receptors with surface water. It did not consider the interaction of GRT7000 or GRT8000/9000 with sediment or the exposure of aquatic receptors to chemical residues in sediment.

Toxicity Assessment

Two types of samples were submitted for toxicity testing and chemical analysis:

1. Samples of GRT7000 and GRT8000/9000; and

2. Soil stabilised with GRT7000 and GRT8000/9000.

The soil samples were leached, and the toxicity tests and chemical analysis were conducted on the leachate. The product samples were diluted with water to produce a series of test solutions at different concentrations.

ERM received analytical reports from GRT for ecotoxicity testing undertaken on GRT7000 and GRT8000/9000 and leachate using the freshwater cladoceran *Ceriodaphnia cf dubia* in 2013.

The *Ceriodaphnia cf dubia* results were used in conjunction with four additional toxicity tests for each product run in March 2014. The selected toxicity tests considered a range of taxa and included both acute and chronic toxicity tests. The toxicity tests performed for this assessment were:

- 72-hr Microalgal growth inhibition (cell yield) test using the freshwater algae *Selenastrum capricornutum* (based on USEPA method 1003.0, 2002).

- 7-day Growth inhibition of the freshwater aquatic duckweed *Lemna disperma* (based on OECD method 221, 2006).

- 96-hr acute survival test using the freshwater shrimp *Paratya australiensis,* or *Macrobrachium australiensis.*

- 96-hr Fish imbalance toxicity test using the eastern rainbowfish *Melanotaenia splendida splendida.*

The tests were run on dilution series of GRT7000 and GRT8000/9000. The toxicity tests yielded EC_{50} (effective concentration, 50%) values, IC_{50} (inhibitory concentration, 50%), and no observable effects concentrations (NOECs), which are measures of toxicity i.e. they define the relationship between dose and response for the chemical mixtures assessed. Detailed toxicity test methodology is provided in the Ecotox reports included in *Annex A*.

Exposure Assessment

Exposure assessment involves quantification of chemical intake. Since this risk assessment takes a predictive approach to assessing risk rather than determining risks associated with a known release, exposure was not quantified. Exposure assessment was therefore limited to identification of potential pathways for exposures to occur.

Risk Characterisation

The risk characterisation applied the ANZECC and ARMCANZ (2000) method to calculate a risk based screening level (RBSL) for surface water protective of 95% of species. The RBSL for each product was used to calculation a dilution factor, representing the dilution of the application solution required to achieve a no-effect concentration in the surface water.

2.2 *LIVESTOCK*

Receptor Evaluation

The risk assessment focuses on cattle, since cattle are the main type of livestock kept in the vicinity of the Queensland access roads considered in this assessment.

Pathway Evaluation

The assessment considers the primary of intake from soil ingestion from the roadways, and this is consistent with the approach used by the API (2004). The intake from drinking water on cattle was not assessed, as the ecological risk assessment for leaching or run off to a surface water receptor or a direct spill considers species that are more sensitive than cattle.

Toxicity Assessment

The methodology derives Toxicity Reference Values (TRVs) by evaluation of available mammalian studies, focused on chronic or life sensitive stage studies. The methodology focuses on the protection of livestock at the population level (e.g., mortality, growth, and reproduction) of ecological organisation and accordingly used doses at or below which no adverse health effects to the indicator species are expected, even if exposure occurs over an extended duration. This approach is consistent with the ANZECC (2000). In addition, the methodology applies methods to extrapolate data from studies on mice and rats for the development of TRVs for beef cattle using body weight scaling methodology (API, 2004; Sample and Arenal, 1999).

Exposure Assessment

The methodology used relevant exposure parameters within the range of values used in the ANZECC (2000) guidelines. The assessment was done for beef cattle using the assumed body weight of 454kg (API, 2004) and a soil intake rate of 2.13 kg /day (API, 2004). Potential exposure of cattle to the component chemicals in the products was quantified.

Risk Characterisation

The risk characterisation compared the calculated exposure to each chemical to the TRV for each chemical. The risk associated with the product was estimated assuming the toxic effect is additive.

3 PRODUCT APPLICATION

Information in this section was provided by GRT. As noted in *Section 1.2*, GRT products are used on unsealed roadways predominantly for stabilisation of pavements, high traffic areas and for mending potholes. They can also be used for the suppression of dust and providing a stronger and hydrophobic surface which makes the roadway (or high traffic area) more durable.

If the GRT products are to be used for road stabilisation, the surface must be "ripped" with rotary hoe. This is where the upper surface of the roadway is effectively ploughed to allow the soil to have a higher surface area for the application of the GRT product. This is not required if the GRT products are to be used solely for dust suppression.

Prior to the application of GRT products, a light spray of water must be applied to the road.

The GRT products are mixed according to the manufacturer's specifications which will vary from site to site according to soil type, predicted traffic loading and climate conditions. GRT7000 and GRT8000/9000 are stored in IBC containers and mixed with water in a water truck. The ratio of product mixed with water will generally be dependent on:

1. soil conditions and the amount of water required to bring material to its optimum moisture content – in drier conditions, more water will be required;

2. soil cohesiveness – for less cohesive soils, more product will be required; and,

3. road strength required – for heavy vehicles (e.g. mining haul trucks), more product will be required.

This product-water mix is then applied to the surface via the water truck in the same method as water application. It is sprayed from the back of the truck. A multi-tyre roller following immediately behind the water truck must complete a minimum of three passes to compact the road, starting along the shoulder of the road and returning on the crown. The first applications should be completed at least an hour apart to allow for maximum penetration and binding. The next application should be done within two days of the initial two applications. The final application should be done no less than 14 days after the third application. Once the four applications are complete, the roadway is complete and ready for traffic.

4 LABORATORY ANALYSIS AND RESULTS

4.1 METHODOLOGY

GRT supplied undiluted samples of GRT7000 and GRT8000/9000 soil samples treated with 3% GRT7000 and 3 % GRT8000/GRT9000 by weight to Ecotox Services Australia Pty Ltd (Ecotox), Lane Cove, NSW a NATA accredited toxicity testing facility. Ecotox submitted the samples and leachate to ALS Environmental Limited (ALS), Sydney, NSW, for chemical analysis.

Samples of GRT7000 and GRT8000/GRT9000 and soil samples stabilised with the GRT products were submitted to Ecotox on 15 July 2013 for the 48-hr acute toxicity test using *Ceriodaphnia cf dubia*. The tests were conducted following a procedure based on USEPA (2002) and Bailey et al. (2000).

The samples for the remaining toxicity tests were submitted to Ecotox on 10 March, 2014. As noted in *Section 2*.1, the toxicity tests conducted included:

- 72-hr Microalgal growth inhibition (cell yield) test using the freshwater algae *Selenastrum capricornutum* (based on USEPA method 1003.0, 2002).
- 7-day Growth inhibition of the freshwater aquatic duckweed *Lemna disperma* (based on OECD method 221, 2006).
- 96-hr Acute survival test using the freshwater shrimp *Paratya australiensis,* or *Macrobrachium australiensis.*
- 96-hr Fish imbalance toxicity test using the eastern rainbowfish *Melanotaenia splendida splendida.*

A dilution series was prepared for the toxicity tests using the GRT products and dilute mineral water. For the *Ceriodaphnia cf dubia* tests, the highest test concentration was 400 mg/L. The *Ceriodaphnia cf dubia* dilution series also included test concentrations of 6.3 mg/L, 12.5 mg/L, 25 mg/L, 50 mg/L, 100 mg/L, and 200 mg/L, as well as a dilute mineral water control. For the remaining toxicity tests, the highest test concentration was 1000 mg/L. The dilution series also included test concentrations of 62.5, 125.0, 250.0, 500.0, and 1000.0 mg/L.

For the leachate tests, 100 g of soil stabilised with the GRT products was added to 0.9 L of dilute mineral water and mixed for 24 hours with a magnetic stirrer. The mixture was then left to settle for one hour and the leachate was syphoned off and a dilution series ranging from 6.3 mg/L to 100 mg/L was prepared for toxicity testing and sub-samples of the soil leachate for both GRT7000 and GRT8000/GRT9000 were submitted to ALS for analysis. Within the eco-toxicological laboratory, this soil leachate water was defined as the water available fraction (or WAF), however for the purposes of this report, ERM refer to this water as the soil leachate.

The soil used for the preparation of the samples was reportedly derived from a greenfield site within a forest. The soil was a light brown sandy silt. The treatment resulted in a sample with a surface coating of product. The samples were crushed for the leaching procedure, and the leachate therefore represents leaching from both the treated and untreated portion of the soil sample. This is considered representative of real environmental conditions.

The samples submitted to ALS were analysed for metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc, mercury), total organic carbon (TOC), chemical oxygen demand (COD), biological oxygen demand (BOD), phenols, polycyclic aromatic hydrocarbons (PAHs), total recoverable hydrocarbons, and semivolatile organic compounds (SVOCs). It should be noted that analysis for the concentration of the polymerised product within the leachate sample was not available.

More detailed information regarding the methods employed by Ecotox and the results obtained are provided in the laboratory reports in *Annex A*. The ALS laboratory reports are included in *Annex B*.

4.2 RESULTS

4.2.1 Toxicity Testing

A summary of the toxicity test results is presented in the tables below. Both the most commonly reported endpoint for the test (i.e. the IC_{50} or EC_{50}) and the NOEC were included in the tables.

Table 4.1 Toxicity Test Results for GRT7000

Test	NOEC	IC50	EC50
Ceriodaphnia cf dubia 48-hr acute toxicity test	6.3		15.3
Microalgal 72-hr growth inhibition	500	>1000	
Duckweed 96-hr growth	1000	>1000	
Shrimp 96-hr survival	1000		>1000
96-hr fish imbalance	1000		>1000
All values in mg/L			

Table 4.2 Toxicity Test Results for GRT7000 Soil Leachate

Test	NOEC	IC50	EC50
Ceriodaphnia cf dubia 48-hr acute toxicity test	50,000		93,400
All values in mg/L			

Table 4.3 Toxicity Test Results for GRT8000/GRT9000

Test	NOEC	IC50	EC50
Ceriodaphnia cf dubia 48-hr acute toxicity test	100		217.1
Microalgal 72-hr growth inhibition	250	>1000	
Duckweed 96-hr growth	1000	>1000	
Shrimp 96-hr survival	1000		>1000
96-hr fish imbalance	1000		>1000
All values in mg/L			

Table 4.4 Toxicity Test Results for GRT8000/GRT9000 Soil Leachate

Test	NOEC	IC50	EC50
Ceriodaphnia cf dubia 48-hr acute toxicity test	6,300		10,900
All values in mg/L			

Ceriodaphnia cf dubia 48-hr acute toxicity test yielded the lowest NOECs for both GRT7000 and GRT8000/GRT9000, followed by the microalgal 72-hr growth inhibition. For the remaining tests on GRT7000 and GRT8000/GRT9000, the NOECs were 1000 mg/L i.e. the maximum concentration in the dilution series tested. The NOECs for these tests therefore present a very conservative measure of toxicity.

Ceriodaphnia cf dubia were more sensitive to GRT7000 than to GRT8000/GRT9000; however, the reverse was noted for the *Ceriodaphnia cf dubia* test on GRT7000 and GRT8000/GRT9000 soil leachate samples. The microalgal 72-hr growth inhibition test also yielded a lower NOEC for GRT8000/GRT9000 than for GRT7000.

GRT7000 and GRT8000/GRT9000 soil leachate samples had significantly lower toxicity than GRT7000 and GRT8000/GRT9000, particularly for GRT7000 where the values differed by five orders of magnitude.

4.2.2 Soil Leachate Chemical Analysis

The analytical results of the two soil leachates from the GRT7000 and GRT8000/9000 from ALS indicated that:

- analysis for the polymerised product was not available;
- all TRH, BTEX, PAHs, SVOCs and VOCs were below their detection limits;

- metal concentrations were detected and are considered likely to be related to the leachate from the soils component of the mixture. The exception to this is nickel, which may be present within GRT 8000/9000. The nickel concentrations in the GRT8000/9000 soil leachate were over twice the concentration in the GRT7000;

- total organic carbon.(TOC) concentrations were 10 mg/L and 9 mg/L for GRT7000 and GRT 8000/9000 respectively. It was considered that as this soil (silty sand) was derived from within a forest, there is a high potential for this TOC concentration to be related to soil organic material, such as humic substances that were not detected within the TRH or PAH analysis;

- styrene is one of the polymer primers present in both GRT7000 and GRT8000/9000. It was not detected in either sample, however as this compound is considered volatile, the sample preparation method is likely to have allowed the volatilisation of any potential styrene within the soil leachate;

- chemical oxygen demand was 61 mg/L and 37 mg/L in GRT7000 and GRT8000/9000 respectively;

- biological oxygen demand was <2 and 3 in GRT7000 and GRT8000/9000 respectively; and

- pH values were generally neutral at 7.65 and 7.18 in GRT7000 and GRT8000/9000 respectively.

5 CHEMICAL AND TOXICITY PROFILES FOR LIVESTOCK ASSESSMENT

The assessment of the toxicity of the products with regards to cattle has been undertaken without the benefit of direct ecotoxicological analysis on the whole products as was undertaken for the aquatic species defined for surface water environments. As such, the chemical compositions of the products, as defined in their relevant MSDS sheets has been reviewed. The toxicity of each chemical component of the products was investigated. Following this, a list of the chemicals of concern was created, in which those chemicals that might potentially be toxic to cattle were identified for quantitative evaluation.

5.1 CHEMICAL PROPERTIES OF GRT7000

GRT7000 is a copolymer based on styrene acrylate in a water soluble emulsion. GRT7000 can be used in preparation, stabilisation, encapsulation and binding of various soils, aggregates, minerals and biogenic substances. It is used in road making operations to form a road sub-base layer. The product also has applications in the primary production industries to form impervious hardstand areas.

GRT7000 is a white liquid which is slightly alkaline with a pH typically ranging between 8 and 9.5. The chemical agents in GRT7000 are soluble in water and non-volatile.

Information on the chemical composition of GRT7000 was restricted to the ingredients listed in the Material Safety Data Sheets (MSDS) which is provided in *Annex C*. The composition of GRT7000 is presented in *Table 5.1*. It is noted that trace constituents, that may include organic chemicals and metals, are not listed within the MSDS.

Table 5.1 Chemical Composition of GRT7000

Chemical Name	CAS No.
Hybrid-styrene copolymer	Proprietary
Water	7732-18-5
Other Non-Hazardous Ingredients	Proprietary

1. Refer to MSDS in *Annex C*.product
2. Exact ration of components may vary slightly.

5.2 CHEMICAL PROPERTIES OF GRT8000 AND GRT 9000

GRT8000 and GRT 9000 are polymerised bitumen preparations which are mixed with various soils and aggregates used in road making operations and for dust control purposes. These products are suitable for highways, pavements, urban roads and rural roads.

GRT8000/9000 is an opaque brown liquid which is alkaline with a pH typically ranging between 9 and 11. The products are water soluble and non-volatile.

Information on the chemical composition of GRT8000 and GRT900 were restricted to the ingredients listed in the MSDSs which are provided in *Annex C*. These products are considered to be the same, however the MSDS sheets present slightly different percentage ranges for the chemical compositions.

The composition of GRT8000 is presented in *Table 5.2* and the composition of GRT9000 is presented in *Table 5.3*. It is noted that trace constituents, that may include organic chemicals and metals, are not listed within the MSDS.

Table 5.2 Chemical Composition of GRT8000

Chemical Name	CAS No.
Bitumen	8052-42-4
Emulsifier	Proprietary
Hybrid –styrene polymer	Proprietary
Water	7732-18-5
Other Non-Hazardous Ingredients	Proprietary

1. Refer to MSDS in *Annex C*.
2. Exact ratio of components may vary slightly.

Table 5.3 Chemical Composition of GRT9000

Chemical Name	CAS No.
Bitumen	8052-42-4
emulsifier	Proprietary
Hybrid-styrene copolymer	Proprietary
Water	7732-18-5
Other Non-Hazardous Ingredients	Proprietary

1. Refer to MSDS in *Annex C*.
2. Exact ratio of components may vary slightly.

5.3 CHEMICALS OF CONCERN

The primary chemicals of concern, based on the information provided in the MSDS, include:

- bitumen;
- hybrid-styrene copolymer; and
- emulsifier

ERM entered into a confidentiality agreement with the proprietor, which allowed ERM to review the proprietary chemical components of the products. The proprietary chemicals reviewed are only referred to in general terms in this report. The proprietary information related to the composition and identities of the primary chemicals (or chemical mixes) of concern listed above.

All three of the primary chemicals of concern comprise a mixture of chemical compounds, primarily mixtures of polymer primers and petroleum hydrocarbons. In order to assess the risks to livestock, the individual components were investigated. Non-hazardous ingredients were not included. It was found that for many of the components, valid toxicological data relevant to mammalian toxicity assessment did not exist. Consistent with risk assessment methodologies for petroleum mixtures (CRC CARE, 2011; TPHCWG, 1997), surrogate compounds were chosen to represent the varying chemical mixtures. Listed below are the chemical mixtures that make up the each GRT product assessed and the percentage calculated of each in each GRT product.

Table 5.4 Estimated compositions of the products

**** Please Contact Global Road Technology***

The above percentages have been taken from the MSDS sheets for the overall products and then from estimates in literature for further breakdown, including:

- WHO International Programme on Chemical Safety, Inchem *Concise International Chemical Assessment Document 59, Asphalt (Bitumen),* 2004.

- Total Petroleum Hydrocarbon Criteria Working Group Series, *Volume 2 Composition of Petroleum Mixtures*, May 1998.

6 TOXICITY ASSESSMENT

6.1 TOXICITY REFERENCE VALUES FOR AQUATIC ECOLOGICAL RECEPTORS

The toxicity of complex mixtures is most effectively assessed by conducting product-specific toxicity tests, as toxicity reference values (TRVs) for individual chemicals may fail to take into account additive, synergistic, or antagonistic effects of chemicals mixed together. The toxicity assessment for aquatic ecological receptors was therefore based exclusively on the results of the Ecotox toxicity tests presented in *Section 4.2.1*.

6.2 TOXICITY REFERENCE VALUES FOR LIVESTOCK

The toxicity to livestock was not able to be assessed based on tests for cattle exposure directly to the products in the same way as for ecological receptors. ERM has undertaken this assessment consistent with ANZECC (2000) and United States Environmental Protection Authority (USEPA) (2004) guidance and the API (2004) methodology. The selection of relevant toxicity data focused on the protection of livestock at the population level (e.g., mortality, growth, and reproduction) of ecological organisation and accordingly used doses at or below which no adverse health effects to the indicator species are expected, even if exposure occurs over an extended duration. As such, higher weight in the development of toxicity reference values (TRVs) was given to the available studies based on no adverse population level effects.

The studies on toxicity of the component compounds in GRT7000, GRT8000 and GRT9000 (bitumen, the emulsifier and acrylic polymers) and the hazards associated with exposure levels that could potentially occur during the application and use are presented in the toxicity profiles presented in *Annex D*.

The TRVs were calculated using the following equation:

$$TRV = NOAEL \times sf \qquad \text{(Equation 1)}$$

where TRV = toxicity reference value (mg/kg-d)

NOAEL = Chronic No Adverse Effects Level (mg/kg-d)

sf = body weight scaling factor (unitless)

None of the chemical components of the GRT7000, GRT8000 or GRT9000 products evaluated had toxicity data available in literature for livestock. Therefore, toxicity data selected to apply to beef cattle are from much smaller animals (e.g. rats and mice). Extrapolation from the small weight test animals was done using published methods for developing ecological benchmarks (API 2004; Sample et al. 1996; Sample and Arenal 1999).

A body weight scaling factor was applied to allometically adjust for the body weight differences. The body weight scaling factor is calculated using the following equation (API 2004; Sample and Arenal 1999):[1]

$$SF = \left(\frac{BW\ Testspecies}{BW\ Targetspecies}\right)^{4} \qquad \text{(Equation 2)}$$

where BWtestspecies = body weight of the test species (kg)

BWtargetspecies = body weight of the target species, beef cattle (kg).

For body weight scaling calculations target species body weights were assumed to be 0.035 kg for mice, 0.35 kg for rats and 10 kg for dogs (ANZECC, 2000).

Where chronic data or data representing NOAELs were not available, an uncertainty factor was considered in the development of the TRV using the following equations:

$$ChronicNOAEL = \frac{Sub\ \ ChronicNOAEL}{UF} \qquad \text{(Equation 3)}$$

or

$$ChronicNOAEL = \frac{ChronicLOAEL}{UF} \qquad \text{(Equation 4)}$$

where UF – uncertainty factor [For sub-chronic to chronic extrapolations and LOAEL to NOAEL extrapolation an UF of 10 was applied (ANZECC, 2000; API, 2004)].

LOAEL = Lowest Adverse Effects Level (mg/kg-d)

7 *EXPOSURE ASSESSMENT*

Fundamental to the risk assessment process is the development of a Conceptual Model, which is the qualitative description of the plausible mechanisms by which receptors may be exposed to chemicals. For exposure (and therefore risk) to be considered possible, a mechanism ('pathway') must exist by which a chemical can reach a given receptor. A complete 'source-pathway-receptor' exposure mechanism is referred to as a 'SPR linkage'.

The potential SPR linkages are evaluated for completeness based on the existence of:

- a potentially hazardous chemical source;
- a mechanism for release of the chemical or hazard from the source;
- potential receptors that are sensitive to the hazard; and
- a mechanism for receptors to come into contact with the chemical.

Whenever one or more of these elements are missing, the SPR linkage is incomplete and the potential risk to the identified receptor is considered unlikely. This mechanism for analysing potential risks is relevant to both livestock and ecological risks. A summary of the SPR linkages are summarised in *Table 7.1*.

Table 7.1 Key source-pathway-receptor linkages

Source	Pathway	Receptor	Link?	Discussion	Quantitative Assessment?
Ecological Assessment					
Product from water truck	Direct contact – spill into surface waters	Ecological receptors in surface water	Y	In the event of a spill, GRT products could potentially reach surface water bodies and ecological receptors in those water bodies. RBSLs were calculated for GRT7000 and GRT8000/GRT9000 based on the toxicity test data. Aquatic ecological receptors would not be exposed to the full strength product. The products are generally diluted to 1:6 ratio with distilled water prior to application. Further dilution would occur upon release into the environment, including dilution in drainage ditch water, streams, groundwater, and/or water holes. The dilution factor required to meet the calculated RBSLs was therefore calculated.	Y
Stabilised soil*	Overflow/ run off	Ecological receptors in surface water	Y	Due to the nature of the products, following polymerisation or stabilisation, there is limited potential for leaching. The products are hydrophilic to ensure that the roadway does not weather easily. As such, it is unlikely that much water will drain through the stabilised roadway. It is also considered that run-off from the roadways is unlikely to contain significant quantities of dissolved chemicals from the products due to the limited period of time that the water would be in contact with the roadway. The chemical analysis of the soil leachates supports this expectation (see *Section 4.2.2*). ERM consider that the leachate test method involving crushed samples of a higher concentration than used in the field followed by a 24 hour period of leaching will provide a much higher concentration than would be expected from rainfall runoff or leaching through the roadway soils.	N
	Infiltration/ migration		Y		N
Livestock Assessment					
Stabilised soil	Direct contact – dermal exposure	Livestock	Y	There is potential for livestock to come in direct contact with the stabilised soil following the "setting" period (after 72 hours of application and polymerisation). Should livestock graze near the roadway and potentially lie on the roadway, they will be exposed to the stabilised soil. The dermal absorption of petroleum hydrocarbons in livestock is considered a minor exposure pathway due to their thick coats. Health effects from dermal exposure to hydrocarbons have been shown to be negligible for most terrestrial mammals (API, 2004).	N
	Accidental ingestion	Livestock	Y	There is potential for livestock to ingest either dusts from the roadway or accidentally eat roadway soils during grazing. Livestock are known to ingest hydrocarbons from pipe leaks and this may be due to curiosity or for adding salt to their diet. They are also known to ingest a substantial amount of soil in their diet. This is considered to be the most effective potential exposure pathway (API, 2004). This may be mitigated if livestock are rotated through a property where the roadway is only present in some fields. This potential exposure is considered quantitatively in *Section 8.2*.	Y

Source	Pathway	Receptor	Link?	Discussion	Quantitative Assessment?
	Inhalation	Livestock	N	The potential for inhalation of the stabilised soil products is marginal. The volatile components of the mixture are primers for the polymer setting agents. Once the polymer is set, it is considered unlikely that volatiles will be present within the stabilised soils. Also with regards to any residual vapours, as the roadways are sited outdoors so there is a low likelihood for the accumulation of any potential vapours due to the rapid dilution and dispersion in ambient air. [API, 2004]. An added factor of safety would be provided given that it is unlikely that cattle will be within the vicinity during the setting period and as such are unlikely to come in contact with the volatile primers. If the cattle were in the area, the exposure would be acute rather than an ongoing chronic exposure over the course of a life time. As such, for the purposes of the cattle assessment, the products are not considered to be volatile.	N

8 RISK CHARACTERISATION

8.1 AQUATIC RECEPTOR RISK CHARACTERISATION

8.1.1 Soil Leachate Results

For the purposes of assessing the environmental mobility of potential contaminants in the soil, two soil samples were prepared for the soil leachate analysis. The first soil sample was treated with GRT7000 by weight and the second sample was treated with GRT8000/GRT9000 by weight.

It should be noted that the application methodology suggests that in the worst case scenario only 0.38% of product is actually applied to soils (See *Section 8.2.2*). It should also be noted that the soil leachate method, described in *Section 4.1*, is very aggressive compared to what could be expected from leachate from rainfall run off or infiltration. As such, the quantity of product in the samples and the leachate procedure are considered likely to yield higher concentrations in the leachates than would be expected in the field.

Styrene, a component chemical with significant aquatic toxicity was not detected in the leachates from the GRT7000 and GRT8000/9000 treated soil samples. However, it is considered likely that styrene, as with all other VOCs and potentially SVOCs, if present in the soil sample would have volatilised during the leaching procedure. This is considered reasonably comparable to what would be expected in the environment in the event that leachable styrene remained in the stabilised roadway for a period of time after application.

The measured pH did not indicate impacts from the products since as the leachates from both soil samples were neutral. GRT7000 is neutral and GRT8000/9000 are alkaline. Neutral treated soil indicates fully reacted products in the samples without sufficient excess to exceed the soil's buffering capacity.

TOC concentrations were 10 mg/L and 9 mg/L for GRT7000 and GRT 8000/9000 respectively. It was considered that as this soil (silty sand) was derived from within a forest, there is a high potential for this TOC concentration to be related to soil organic material, such as humic substances that were not detected within the TRH (including BTEX) or PAH analysis or any of the other identified toxic organic compounds.

Overall, although the application of this analysis is limited, it does indicate that the leached fraction via rainfall runoff or infiltration through the sealed soils is unlikely to yield concentrations of the key toxic organic contaminants of interest above detection levels.

8.1.2 Ecological RBSL Calculation

ANZECC and ARMCANZ (2000) puts forward two methods to derive water quality screening values:

- a risk-based statistical distribution approach; and
- an assessment factor (AF) approach.

Where possible, ANZECC recommends using the statistical distribution approach; however, the data set must meet certain criteria to use this method. The two approaches are described below.

Statistical Distribution Approach

The statistical method used by ANZECC is called the Burr Type III statistical distribution (BT III SD) method developed by Shao (2000) which was based on the Aldenburg and Slob (1993) method. Depending on the availability of data, either a high reliability or a moderate reliability guideline was derived using the BT III SD method.

In order to derive a screening level via the risk-based statistical distribution approach, toxicity data from at least five (5) different species from four (4) different taxonomic groups are required. If there are sufficient NOEC data from chronic or sub-chronic tests, a high reliability Ecological RBSL can be calculated. If acute, rather than chronic or sub-chronic, data are used, the value derived is characterised as a moderate reliability screening level.

Assessment Factor Approach

The AF approach is used to derive screening levels when there is insufficient data to derive screening levels via the statistical distribution approach. An AF is a value applied to toxicity data to account for the uncertainty associated with using laboratory toxicity data for one species collected over a relatively short period of time in a controlled environment to set a trigger level that is protective of long-term exposure for a range of organisms in variable field conditions.

As such, the magnitude of the AF depends on whether acute or chronic toxicity data are available and the degree of confidence in whether the figures reflect the field situation. Most of the AFs are multiples of 10, with larger factors applied where there is less certainty in the data.

The acceptable types of single-species toxicity data and corresponding AFs applied to derive the Ecological RBSLs are summarised in *Table 8.1*.

Table 8.1 Toxicity Data Requirements for AF Application

Type of Toxicity Data	Minimum Data Requirements (toxicity data points)	Assessment Factor
Chronic NOEC	1 x fish NOEC, 1 x invert NOEC, 1 x algae NOEC	20
Acute LC_{50}/EC_{50}	3 or greater	100
Lowest Chronic NOEC	2 or less	200
Any toxicity data	2 or less	1000

Note that while 3 or more data points are required to apply an AF of 20 or 100, the AF is applied only to the lowest of the toxicity data points.

Approach Applied to Calculate RBSLs

The toxicity tests run on GRT7000 and GRT8000/GRT9000 by Ecotox met the minimum criteria for applying a statistical approach. RBSLs were calculated using the BurrliOZ statistical software. BurrliOZ was developed by CSIRO for Environment Australia, and uses the Burr Type III distribution to estimate the concentration of a chemical such that a given percentage of species will survive. It gives users the flexibility to obtain a range of trigger values depending on the level of species protection required (i.e. 80%, 95%, or 99% species protection). Greater detail regarding the BT III SD method is provided in Warne (2001) and Shao (2000). A summary of the input data and the BurrliOz output is presented in *Table 8.2*. For the purpose of deriving Ecological RBSLs for the GRT products, a 95% species protection level was applied.

Table 8.2 BurrliOz Output for GRT7000 and GRT8000/9000

Product	RBSL protective of 95% of species (mg/L)
GRT7000	12.1
GRT8000/GRT9000	110

Given that only five toxicity data points were available for each GRT product and that only the 48-hr *Ceriodaphnia cf dubia* acute toxicity test and the 72-hr microalgal growth inhibition test had NOECs lower than the maximum tested concentration, the results were interpreted with caution as they might not adequately address potential risks to the most sensitive species, *Ceriodaphnia cf dubia*. Ecological RBSLs were therefore also calculated using the AF approach and the results compared with the statistically-derived RBSL.

Based on the toxicity data available, an AF of 100 was applied to the NOEC data from the toxicity test. RBSLs were calculated for the two test species for which the NOECs were lower than the maximum test concentrations, as well as for the maximum test concentration.

Table 8.3 Ecological RBSLs Calculated Using AF Approach

Product	Based on *Ceriodaphnia cf dubia* (mg/L)	Based on Microalgae (mg/L)	Based on Maximum test Concentration (mg/L)
GRT7000	0.063	5	10
GRT8000/GRT9000	1	2.5	10

For both GRT7000 and GRT8000/9000, the Ecological RBSL derived using BurrliOz was greater than the Ecological RBSL calculated using the AF approach on the maximum test concentration. The statistically-derived Ecological RBSL would not be protective of *Ceriodaphnia cf dubia* in the event that the organisms were to come into contact with the full strength product. The risk of this occurring is considered negligible. Since the products are diluted prior to application and further dilution in the environment is likely, the statistically-derived Ecological RBSLs are considered a reasonable threshold by which to gauge the potential for toxic effects to the majority of aquatic species.

8.1.3 Dilution Factors in the event of a direct spill of application solution

Dilution factors have been calculated to provide an indication of how much dilution of the application solution is required to meet the trigger values in the event of a spill directly to a surface water body. Given that the mixture is already diluted at a ratio of * prior to application. ERM have assumed a 1.02g/mL density (or 143 mg/L).

A dilution factor is the ratio of the quantity of impacted water to the average quantity of diluting water available at the point of disposal or at the point of the receiving water body.

Table 8.4 Dilution Factor for GRT7000 application solution

Source of RBSL	Ecological RBSL	Product concentration in water following * dilution within tank	Dilution in potential receiving water body of tank mix of water and product required to meet Ecological RBSL
BurrliOz	12.1 mg/L	143 mg/L	11.8 times

Table 8.5 Dilution Factor for GRT8000/9000 application solution

Source of RBSL	Ecological RBSL	Product concentration in water following * dilution within tank	Dilution in potential receiving water body of tank mix of water and product required to meet Ecological RBSL
BurrliOz	110 mg/L	143 mg/L	1.3 times

*Please contact Global Road Technology

8.2 LIVESTOCK RISK CHARACTERISATION

8.2.1 Stock Ingestion Screening Level Calculation

A stock ingestion risk based screening level (Livestock RBSL) is a calculated concentration used as a threshold for screening chemical concentrations in soils. If soil concentrations are below this established chemical concentration, the soil is considered to be unlikely to result in a risk to health of the cattle via ingestion.

Following the API (2004) methodology, Livestock RBSLs for concentrations of chemicals in soil / road materials were calculated using the following equation:

$$SoilIngestionRBSL \quad \frac{1 \times BW \times TRV}{IRsoil} \times AUF \qquad \text{(Equation 5)}$$

where RBSL = Livestock risk based screening level (mg/kg);

BW = body weight of beef cattle (kg)

TRV = toxicity reference value (mg/kg-d)

IRsoil = stock soil ingestion rate (kg/d)

AUF = Area Use Factor (unitless)

The inputs and results of the calculations are provided in *Annex E, Table E1*. A summary of the resulting RBSLs for each chemical identified to be present within the products is presented in Table 8.6, below.

Table 8.6 . Calculated RBSLs for chemical constituents of GRT 7000 and GRT8000/9000

Chemical Constituent of products (GRT 7000 or GRT8000/9000)	Soil Ingestion Livestock RBSL (mg/kg-day)	Soil Ingestion Livestock RBSL with AUF (mg/kg-day)
Oil	2770.3	277028.1
Styrene	1775.8	177582.1
Polymer Acid	177.6	17758.2
Aliphatics (n-alkanes)	20.0	1997.2
LowPAHs	1775.8	177582.1
HighPAHs	3551.6	355164.3
Asphaltenes	3551.6	355164.3
Hard resins	3551.6	355164.3
Soft resins	3551.6	355164.3
Oils	886.7	88668.5
Waxes	362.3	36234.7
Vanadium	2770.3	277028.1
Nickel	1775.8	177582.1

Body Weight

ERM have used the guidance in the American Petroleum Institute, *Risk-Based Screening Levels for the Protection of Livestock Exposed to Petroleum Hydrocarbons*, July 2004.

The body weight used under this guidance was 454kg and this has been used for ERM's calculations. BioSecurity Australia undertakes similar risk assessments and the body weight they use is 500kg. (The lower body weight is considered to be more conservative.

Soil Ingestion

The exposure to soils via ingestion for cattle is via consumption of grasses. It is assumed that soils attached to the edible grasses will be ingested during grazing. It is considered that inadvertent soil ingestion during grazing can comprise a large proportion of the cattle diet. The standard mass of soil conservatively assumed to be ingested is 2.13kg per day (API, 2004).

Note that this soil intake is related to the soil directly under or adjacent to the grasses being eaten. It is unlikely that cattle soil ingestion will come entirely from the soils adjacent to the roadway which could contain the products. It is considered that grazing grasses and plants will not be growing in the actual roadway, though may be growing directly adjacent to the roadway and this may account for exposure to the dust control product.

Area Use Factor

The Area Use Factor was incorporated into the calculation in order to account for the fact that cattle are unlikely to graze continuously on or adjacent to the roadway. ERM considered 1% was a reasonable estimate for the time spent eating adjacent to the roadway and as such, the RBSLs have been adjusted to incorporate this factor.

8.2.2 Soil Concentration Calculation

For comparison to the Livestock RBSLs listed in *Table 8.6*, it is necessary to estimate a reasonable average concentration for each chemical that is assumed to be present in the roadway soil eaten by the cattle. It is designed to represent a "reasonable worst case" concentration. The preparation of the solution prior to application has been summarised in Section 2. ERM have considered the most concentrated solution mix specified. These ratios were used to calculate the concentrations of the chemicals within the water truck prior to application.

The Toxicological Report on GRT7000 and GRT8000/9000 Soil Stabilisers (*Annex D*) detailed a typical treatment for soil which has been incorporated into this risk assessment to provide an estimate of the volume of product applied per volume of soil.

$$\frac{\text{Volume Applied}}{\text{Area} \times \text{Depth} \times \text{Density}} \times 1000 = Concentration\ in\ Prepared\ Soil(L/kg)$$

[Equation 6]

Volume Applied = The product following dilution in the water truck is applied at a rate of 2L per square metre, but the maximum reported rate was 4L per square metre.

Area = 10,000 cm^2 (1 square metre)

Depth = the product is applied typically at 15 cm depth, a minimum of 10cm depth was applied for the purposes of this calculation to present the most conservative scenario

Soil density = 1.5 g/cm^3

This calculation indicated that 0.00267 L/kg of the diluted application mixture could be expected in the prepared roadway soils, assuming that there is complete and even mixing within the top 10cm, which is the depth that is ploughed. This concentration volume per kg of application solution of the products has been used to calculate the concentration of each product in the roadway soils in mg/kg using Equation 7, below.

$$0.0026 \frac{L}{kg} \times \frac{Concentration\ of\ Product\ in\ Water\ Truck\ \left(\frac{g}{L}\right)}{} \times 1000 = Concentration\ in\ Roadway\ Soils\ \left(\frac{mg}{kg}\right)$$

[Equation 7]

Where the concentration of Products (either GRT7000 or GRT 8000/9000)

The concentration of the product in the roadway soils was calculated using a product concentration in the truck of 0,143g/L and the result was 3809.5mg/kg product in soil for both GRT7000 and GRT8000/9000.

The knowledge of the chemicals within the products in GRT 7000 and GRT 8000 and GRT9000 and the percentage ranges quoted on the MSDS sheets were used to calculate approximate chemical concentrations within stabilised soils. In each case, the highest chemical percentage quoted on the MSDS sheets was used. The percentage was applied to the product concentration in roadway soils calculated using Equation 7 to generate a chemical

concentration in soil.

In the cases of the bitumen and the emulsifier, these represent a suite of compounds that were then further segregated into chemicals whose concentrations were estimated for the purposes of this assessment.

The percentage breakdown for chemical components for bitumen and the emulsifier for the purposes of the assessment are presented below.

Table 8.7 Composition of Bitumen for purposes of assessment

Bitumen
Ashaltenes
Hard resins
Soft resins
Oils
Waxes
Vanadium
Nickel

Table 8.8 Composition of Emulsifier for purposes of assessment

Emulsifier	Toxicity Assessment Surrogate	Breakdown by %
Alkyl-Monoaromatics	n-alkanes	2.6 %
Branched Alkanes	n-alkanes	12.3%
Diaromatics (except naphthalene)	Low chain length PAHs	0.0099%
Monoaromatics	Low chain length PAHs	3.8%
n-alkanes	n-alkanes	71.2%
Naphthalenes	Low chain length PAHs	5.0%
PAHs (split into Light and Heavy)		
total % weight Light PAHs	Low chain length PAHs	5.2%
total % weight High PAHs	High chain length PAHs	0.0073%

The above calculations are presented in *Annex E Tables E2, E 3* and E*4*. These show the chemical breakdown and the estimated concentration in soils of each component chemical.

8.2.3 Hazard Quotient and Hazard Index Calculation

Following the calculation of the concentrations of the chemicals in the roadway soils, and the calculation of the Livestock RBSLs as detailed in Section 8.2.1, the relevant hazard quotient for each chemical and the resulting hazard index for the soil were calculated. The hazard index is used to assess the cumulative risk to cattle health from all the chemical components of the products that may be present in the roadway soils.

$$HQ = \frac{Soil\ Concentration}{Soil\ Ingestion\ RBSL}$$

and

$$HI = SUM\ of\ all\ HQs$$

[Equations 8 and 9]

Where,

HQ = Hazard Quotient, which is an indicator of the health hazard obtained by dividing the estimated concentration in the soil of each chemical (as calculated in Section 8.2.2) by the RBSL.

HI = Hazard Index, which is the sum of more than one hazard quotient for multiple chemicals. This accounts for the cumulative exposure to all the chemicals in the products used. This is a unit less value which is considered as a fraction of 1, whereupon the soil concentrations will be considered to present a potential risk to the identified receptor if the HI were greater than 1.

Annex E, Tables E2, E3 and E4 show the estimated concentration in soils of each component chemical and their corresponding RBSLs, the resulting hazard quotient and the hazard index.

8.2.4 Results of Risk Calculations

The calculations shown in Tables E2, E3 and E4 in Annex E, detail how the HQ and HIs were derived.

The calculated Hazard Indices for each product in the application solution with respect to cattle ingestion are listed below:

- GRT7000 – 3.86×10^{-3}
- GRT8000 – 9.93×10^{-3}

GRT9000 – 8.9 x 10^{-3}All HIs are considerably below 1 and as such are not considered to present a risk to cattle on the farms in the vicinity of the access roadways treated with GRT products.

8.2.5 Uncertainty Analysis

One area that was considered to represent an estimate and may change according to field size or grazing habits of the cattle, was the AUF (Area Use Factor), which was assumed to be 1% to account for cattle grazing in all areas of the fields. Should this not be removed from the calculation to reflect cattle that graze exclusively adjacent to the roadway and only ingest roadway soil, the resulting Hazard Indices would be generated:

- GRT7000 – 0.386
- GRT8000 – 0.993
- GRT9000 – 0.890

Once again, all hazard indices are below 1, indicating that these products as applied do not present a risk to cattle on the farms in the vicinity of the access roadways to be treated with GRT products. ERM do not consider that GRT7000 or 8000/9000 present a risk from soil ingestion to cattle.

8.2.6 Market Assessment

Food Standards Australia New Zealand

Australia and New Zealand Food Standards Code is a set of food safety standards for all aspects of food safety. It is a legislative instrument that is enforced by State and Territory and New Zealand agencies. They publish a set of Maximum Residue Limits for particular potential food contaminants. These limits are established by scientists within the Australian Pesticides and Veterinary Medicines Authority and mainly relate to metals, pesticides and veterinary medicines, as detailed below.

Food Standards Australia New Zealand has not published Maximum Residue Limits for any substance that is relevant to the three GRT products assessed in this report. Relevant common substances could be, for example, asphalt or fuel petroleum hydrocarbons. The reason that no limits are provided is likely to be the low relative toxicity, the fact that these products are not used directly on animals, and that they are not considered likely to result in potentially harmful residues in animal products.

Australian Pesticides and Veterinary Medicines Authority (APVMA)

The Australian Pesticides and Veterinary Medicines Authority (APVMA) establish Withholding Periods and Export Slaughter Intervals (ESIs) for specific products that are used as pesticides and for veterinary medicines. This is a period where cattle must be kept alive prior to slaughter to ensure that agricultural compounds that are considered toxic have been metabolised or excreted before the cattle are slaughtered and prepared for export to other trade zones.

None of the three GRT products assessed here, nor constituent compounds or chemical have been are currently registered with the APVMA and as such have no specific ESI ascribed to them.

The Principal Scientific Advisor at Queensland Government Department of Agriculture, Fisheries and Forestry (DAFF), employed to consider agricultural product integrity to minimise trade impacts from residues from contamination, was contacted on the 20 July 2012 to request information on Queensland specific requirements for the products and their assessment. ERM were advised that the GRT products did not require to be assessed by DAFF for the road stabilisation uses described in this report.

Australian Certified Organic

None of GRT's products have currently been registered as suitable for use on an organic farm with the AQIS Organic Approved Certifying Organisations and are not currently listed in the National Standard for Organic and Bio-dynamic Produce, Edition 3.4, July 2009. This does not necessarily mean that their use is a risk to organic status, however it does mean that no organic certification organisation will state, prior to an inspection of a farm, that they consider it is suitable for use.

Based on discussions with the Biological Farmers Association, ERM considers it possible that if the products were used on a road within a field, which has current organic certification, that this certification could be jeopardised. This risk could be overcome, if the products themselves were certified as suitable for use on organic farms.

If GRT wants to be able to state on the product information that it is suitable for use on organic farms, it is recommended that GRT pursues formal registration and certification with the Biological Farmers Association in order to be allowed for use on organic farms according to the manufacturers application instructions. This process would require full disclosure of the ingredients present in the GRT products.

This would allow an assessment and if the product is registered, allow a statement to be released providing reassurance that the correct use of GRT products is unlikely to affect organic status.

The process for a product to be certified is outlined in the Australian Certified Organic Standard, 2010 – Version 1.0, Biological Farmers of Australia.

Whether use of GRT products on roadways is a risk to organic status ultimately depends on the views of the organic certification bodies, however ERM considers there is a possible risk. The information contained within this risk assessment report could potentially be used to provide further information to such an organisation, should further information be required.

9 CONCLUSIONS

ERM conducted a risk assessment on road stabilisation and dust suppression agents (GRT7000, and GRT8000/9000, all supplied by GRT). The primary ingredients are a mixture of petroleum hydrocarbon compounds acting as a surfactant, bitumen, water and polymer primers. The assessment considered the potential risk to the aquatic environment resulting from spillages and run-off / leaching from treated roads, and potential risk to livestock (using cattle) health resulting from grazing adjacent to treated roads. The potential for creation of soil contamination via leaching, effects on meat quality, and risk to organic certification were also evaluated.

The assessment included direct ecotoxicity testing of the products and soils treated with typical application solutions of the products. The soil samples were subjected to a leaching procedure and the resulting leachate chemically analysed. GRT provided the products and the treated soil samples, together with product MSDS and application instructions..

9.1 AQUATIC ECOTOXICITY RISK ASSESSMENT

Aquatic ecological receptors could be exposed via a spill or leaching from the soil after product application. Risk was assessed using the results of the ecotoxicity testing on solutions made from the products mixed with water at a variety of dilutions, and on the treated soils mixed with water. Soil samples were mixed with water and stirred for 24 hours prior to commencing the tests.

Toxicity tests were conducted on five test species. The 48-hr *Ceriodaphnia cf dubia* acute toxicity test was the most sensitive test, followed by the 72-hr microalgal growth inhibition test. The NOECs for the remaining three tests were greater than the maximum test concentration of 1000 mg/L. The soil leachate for GRT7000 and GRT8000/GRT9000 had significantly lower toxicity than products themselves.

RBSLs were calculated for GRT7000 and GRT8000/GRT9000 using the Burr Type III statistical distribution (BT III SD) method (ANZECC and ARMCANZ, 2000). The RBSLs were 12.1 mg/L and 110 mg/L for GRT7000 and GRT8000/GRT9000 respectively. The dilution factor required to achieve a "no effect" concentration was then calculated using the Ecological RBSLs.

For runoff after application, the above levels of dilution for all three products are considered very likely to occur. Although dilution factors were not calculated for the soil leachate toxicity results, the leachates were lower toxicity than the products, and therefore the required dilutions would actually be lower. The risk to aquatic receptors from treated roads via leaching and run-off is therefore considered low.

The event of a direct spillage into a water body of the 6:1 application solution of GRT 7000 or GRT8000/GRT9000 may result in potential harm to a water environment assuming the dilution within the receiving water body is less than the defined dilution factors. The dilution factors presented and the Ecological RBSLs above can be used for further site-specific assessment of spill events.

9.2 CATTLE ASSESSMENT

9.2.1 Cattle Health Risks

Incidental soil ingestion via eating soil attached to grass growing at the edge of treated road was considered the only significant exposure pathway for cattle to become exposed to the products. ERM assessed the potential toxicity to cattle of the potentially toxic chemicals in each product, which were revealed to ERM under a confidentiality agreement but are not individually identified in this report.

The risk assessment indicated that the GRT7000 and GRT8000/9000 products are not considered to present a significant health risk to cattle, assuming that they are used as described in this report.

9.2.2 Market Assessment

ERM assessed the potential risks with respect to the beef cattle marketplace (eg. Australian market, EU market or organic market) based on the understanding of the chemical nature and intended use of the dust suppression material and through a review of relevant government import/export and organic certification guidelines.

ERM found that the Australian Government have not assessed these products for export of cattle, however this is considered to be due to their low risk to export. It is considered very unlikely that the potential exposure could lead to meat containing detectable concentrations of any of the component chemicals. As such, it is considered that use of these products on cattle farms will not result in market risks.

ERM considers that there is a potential risk to organic certification if the products were used in field with current certification.

9.3 ASSESSMENT OF POTENTIAL FOR SOIL AND SEDIMENT CONTAMINATION

The chemical analysis of the leachates from treated soils resulted in no detectable concentration of potentially toxic organic chemicals that could be present in the application solutions. It is therefore considered unlikely that the use of the products could result in contamination of soil or sediment via leaching from treated roadways. Direct spillage of either the products or the application solutions could have contaminative effect.

10 REFERENCES

ANZECC & ARMCANZ (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand), 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

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Annex A

Ecotox Laboratory Reports

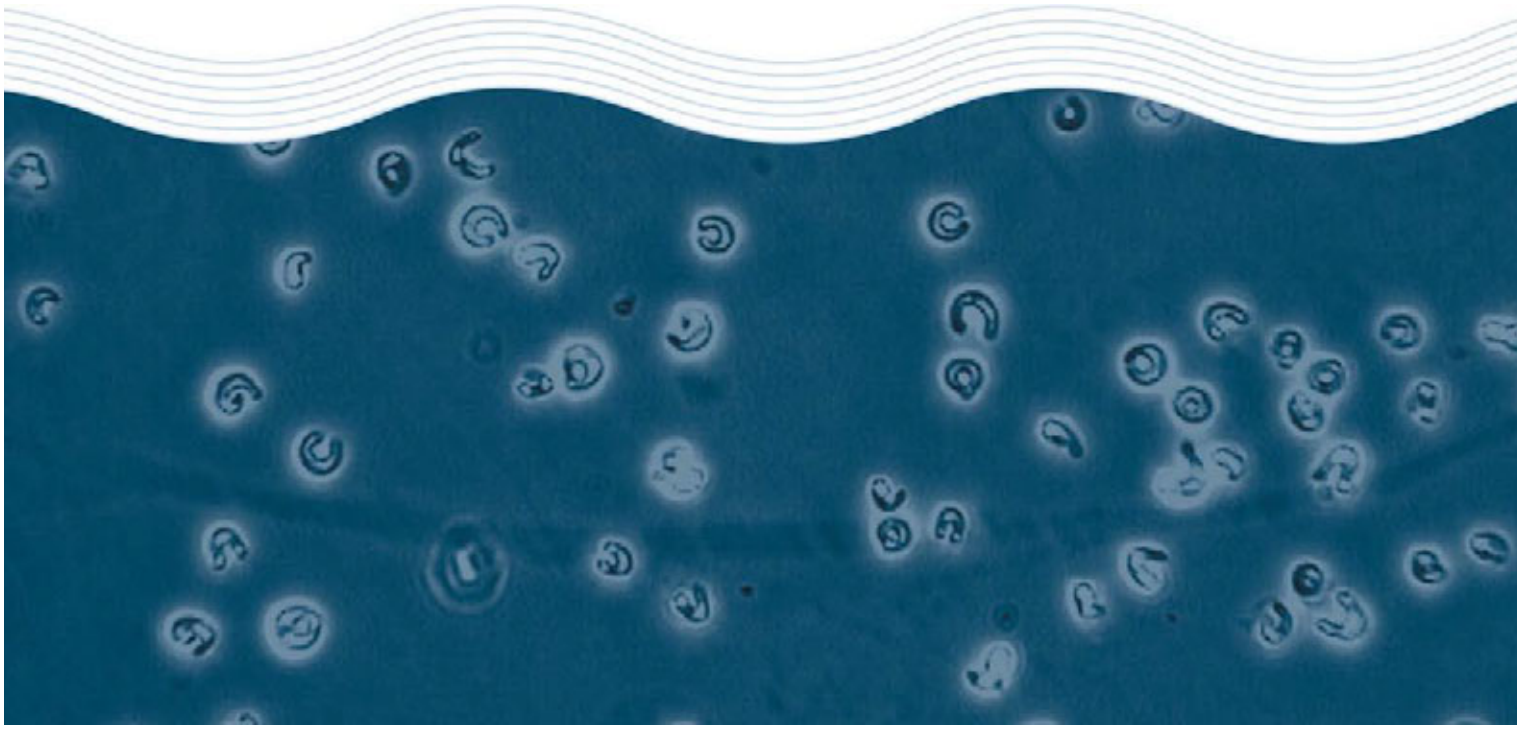
ecotox
SERVICES AUSTRALASIA

Toxicity Assessment of GRT7000 and GRT8000/9000

Global Roads Technology Operations Pty Ltd

Test Report

August 2013



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SERVICES AUSTRALASIA

Toxicity Assessment of GRT7000 and GRT8000/9000

Global Roads Technology Operations Pty Ltd

Test Report

August 2013

ECOTOX Services Australasia Pty Ltd ABN>45 094 714 904
unit 27/2 chaplin drive lane cove nsw 2066 T>61 2 9420 9481 F>61 2 9420 9484 W>www.ecotox.com.au

Toxicity Test Report: TR1067/1

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Client:	Global Road Technology Operations Pty Ltd Level 15 Corporate Centre One 2 Corporate Court Bundall QLD 4218	**ESA Job #:** **Date Sampled**	PR1067 Not supplied
Attention:	Troy	**Date Received:** **Sampled By:** **ESA Quote #:**	15 July 2013 Client PL1067_q01
Client Ref:	Not supplied		

Lab ID No.:	**Sample Name:**	**Sample Description:**
6153	GRT7000	Chemical sample received at room temperature in apparent good condition.

Test Performed:	48-hr acute toxicity test using the freshwater cladoceran *Ceriodaphnia cf dubia*
Test Protocol:	ESA SOP 101 (ESA 2011), based on USEPA (2002) and Bailey *et al*. (2000)
Test	The test was performed at 25±1°C.
	Nil
Temperature:	The highest test concentration of 400mg/L was prepared by adding a weighed aliquot of sample 6153 'GRT7000' into dilute mineral water (DMW). The remaining test concentrations were achieved by serially diluting the highest test concentration with DMW. A DMW control was tested concurrently with the prepared sample.
Deviations from Protocol:	ESA Laboratory culture
Comments on Solution Preparation:	25 July 2013 at 1330h

Sample 6153: *GRT7000*	*Vacant*	*Vacant*
Concentration (mg/L) / **% non-immobilised (Mean ± SD)**		
DMW Control 95.0 ± 10.0		
6.3 90.0 ± 11.6		
12.5 35.0 ± 10.0*		
25.0 25.0 ± 10.0*		
50.0 15.0 ± 10.0*		
100.0 20.0 ± 0.0 *		
200.0 5.0 ± 10.0*		
400.0 0.0 ± 0.0		
48-hr EC10 = <6.3mg/L **48-hr EC50 = 15.3 (8.3-23.3)mg/L** **NOEC = 6.3mg/L** **LOEC = 12.5mg/L**		

*Significantly lower percent immobilisation compared with the DMW Control (Steel's Many-One Rank Test, 1-tailed, P=0.05)

Toxicity Test Report: TR1067/1

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % non-immobilised	≥90.0%	95.0%	Yes
Reference Toxicant within cusum chart limits	150.0-359.1mg KCl/L	236.3mg KCl/L	Yes

Toxicity Test Report: TR1067/1

Test Report Authorised by: Dr Rick Krassoi, Director on 4 September 2013

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

Bailey, H.C., Krassoi, R., Elphick, J.R., Mulhall, A., Hunt, P., Tedmanson, L. and Lovell, A. (2000) Application of *Ceriodaphnia cf. dubia* for whole effluent toxicity tests in the Hawkesbury-Nepean watershed, New South Wales, Australia: method development and validation. *Environmental Toxicology and Chemistry* 19:88-93.

ESA (2011) *SOP 101 – Acute toxicity test using Ceriodaphnia dubia*. Issue No. 9. Ecotox Services Australasia, Sydney, New South Wales.

USEPA (2002) *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. 4th Ed.* United States Environmental Protection Agency, Office of Water, Washington DC.

Toxicity Test Report: TR1067/2

This document is issued in accordance with NATA's accreditation requirements

Client:	Global Road Technology Operations Pty Ltd Level 15 Corporate Centre One 2 Corporate Court Bundall QLD 4218	**ESA Job #:**	PR1067
		Date Sampled:	Not supplied
		Date Received:	15 July 2013
Attention:	Troy	**Sampled By:**	Client
Client Ref:	Not supplied		PL1067_q01

Lab ID No.:	Sample Name:	Sample Description:
6154	GRT8000/9000	Chemical sample received at room temperature in apparent good condition.

Test Performed:	48-hr acute toxicity test using the freshwater cladoceran *Ceriodaphnia cf dubia*
Test Protocol:	ESA SOP 101 (ESA 2011), based on USEPA (2002) and Bailey *et al*. (2000)
Test	The test was performed at 25±1°C.
Temperature:	Nil
Deviations from Protocol:	The highest test concentration of 400mg/L was prepared by adding a weighed aliquot of sample 6154 'GRT8000/9000' into dilute mineral water (DMW). The remaining test concentrations were achieved by serially diluting the highest test concentration with DMW. A DMW control was tested concurrently with the prepared sample.
Comments on Solution Preparation:	ESA Laboratory culture 25 July 2013 at 1330h

Sample 6154: *GRT8000/9000* **Concentration (mg/L)**	**% non-immobilised (Mean ± SD)**	*Vacant*	*Vacant*
DMW Control	95.0 ± 10.0		
6.3	95.0 ± 10.0		
12.5	95.0 ± 10.0		
25.0	100 ± 0.0		
50.0	95.0 ± 10.0		
100.0	80.0 ± 16.3		
200.0	65.0 ± 19.2*		
400.0	10.0 ± 20.0*		
48-hr EC10 = 100.0 (43.8-139.7)mg/L **48-hr EC50 = 217.1 (162.4-284.2)mg/L** **NOEC = 100.0mg/L** **LOEC = 200.0mg/L**			

*Significantly lower percent immobilisation compared with the DMW Control (Dunnett's Test, 1-tailed, P=0.05)

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % non-immobilised	≥90.0%	95.0%	Yes
Reference Toxicant within cusum chart limits	150.0-359.1mg KCl/L	236.3mg KCl/L	Yes

Toxicity Test Report: TR1067/2

Test Report Authorised by: Dr Rick Krassoi, Director on 4 September 2013

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

Bailey, H.C., Krassoi, R., Elphick, J.R., Mulhall, A., Hunt, P., Tedmanson, L. and Lovell, A. (2000) Application of *Ceriodaphnia cf. dubia* for whole effluent toxicity tests in the Hawkesbury-Nepean watershed, New South Wales, Australia: method development and validation. *Environmental Toxicology and Chemistry* 19:88-93.

ESA (2011) *SOP 101 – Acute toxicity test using Ceriodaphnia dubia*. Issue No. 9. Ecotox Services Australasia, Sydney, New South Wales.

USEPA (2002) *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. 4th Ed.* United States Environmental Protection Agency, Office of Water, Washington DC.

Toxicity Test Report: TR1067/3

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Client:	Global Road Technology Operations Pty Ltd Level 15 Corporate Centre One 2 Corporate Court Bundall QLD 4218	**ESA Job #:** **Date Sampled:** **Date Received:**	PR1067 Not supplied 6 August 2013
Attention:	Troy	**Sampled By:**	Client
Client Ref:	Not supplied	**ESA Quote #:**	PL1067_q01

Lab ID No.:	Sample Name:	Sample Description:
6198	Soil stabilised with GRT7000	Solid soil sample received at room temperature in apparent good condition.

Test Performed:	48-hr acute toxicity test using the freshwater cladoceran *Ceriodaphnia cf dubia*
Test Protocol:	ESA SOP 101 (ESA 2011), based on USEPA (2002) and Bailey *et al*. (2000)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	One hundred grams of sample 6198 'soil stabilised with GRT7000' was added to dilute mineral water (DMW) and mixed for 24 hours using a magnetic stirrer. Following mixing, the solutions were left to settle for 1 hour, after which time the water-accommodated fractions (WAFs) were siphoned off. The WAFs were serially diluted with DMW to prepare the remaining test concentrations. A DMW control and a WAF control were tested concurrently with the prepared sample. The test concentrations are expressed as the corresponding loading rates. ESA Laboratory culture 22 August 2013 at 1400h

Sample 6198: *Soil stabilized with GRT7000*	*Vacant*	*Vacant*
Concentration (g/L)	**% non-immobilised**	
DMW Control	95.0 ± 10.0	
WAF Control	100 ± 0.0	
6.3	100 ± 0.0	
12.5	100 ± 0.0	
25.0	80.0 ± 16.3	
50.0	65.0 ± 34.2	
100.0	55.0 ± 25.2*	
48-hr EC10 = 21.4 (9.5-31.9)g/L **48-hr EC50 = 93.4 (62.3-100.0)g/L** **NOEC = 50.0g/L**		

Toxicity Test Report: TR1067/4

LOEC = 100.0g/L

*Significantly lower percent immobilisation compared with the DMW Control (Steel's Many-One Rank Test, 1-tailed, P=0.05)

Toxicity Test Report: TR1067/3

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % non-immobilised	□90.0%	95.0%	Yes
Reference Toxicant within cusum chart limits	150.8-359.8mg KCl/L	212.1mg KCl/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 4 September 2013

Results are based on the samples in the condition as received by ESA.

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Toxicity Test Report: TR1067/4

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Client:	Global Road Technology Operations Pty Ltd Level 15 Corporate Centre One 2 Corporate Court Bundall QLD 4218	**ESA Job #:** **Date Sampled:** **Date Received:**	PR1067 Not supplied 6 August 2013
Attention:	Troy	**Sampled By:** **ESA Quote #:**	Client PL1067_q01
Client Ref:	Not supplied		

Lab ID No.:	Sample Name:	Sample Description:
6199	Soil stabilised with GRT8000/9000	Solid soil sample received at room temperature in apparent good condition.

Test Performed:	48-hr acute toxicity test using the freshwater cladoceran *Ceriodaphnia cf dubia*
Test Protocol:	ESA SOP 101 (ESA 2011), based on USEPA (2002) and Bailey *et al*. (2000)
Test	The test was performed at 25±1°C.
Temperature:	Nil
Deviations from Protocol:	One hundred grams of sample 6198 'soil stabilised with GRT7000' was added to dilute mineral water (DMW) and mixed for 24 hours using a magnetic stirrer. Following mixing, the solutions were left to settle for 1 hour, after which time the water-accommodated fractions (WAFs) were siphoned off. The WAFs were serially diluted with DMW to prepare the remaining test concentrations. A DMW control and a WAF control were tested concurrently with the prepared sample. The test concentrations are expressed as the corresponding loading rates.
Comments on Solution Preparation:	ESA Laboratory culture 22 August 2013 at 1400h

Sample 6199: *Soil stabilized with GRT8000/9000*	*Vacant*	*Vacant*
Concentration (g/L)	**% non-immobilised**	
DMW Control	95.0 ± 10.0	
WAF Control	100 ± 0.0	
6.3	100 ± 0.0	
12.5	30.0 ± 20.0*	
25.0	10.0 ± 11.6*	
50.0	5.0 ± 10.0*	
100.0	20.0 ± 16.3*	
48-hr IC10 = 10.2 (9.3-10.6)g/L **48-hr EC50 = 10.9 (9.0-13.3)g/L** **NOEC = 6.3g/L** **LOEC = 12.5g/L**		

*Significantly lower percent immobilisation compared with the DMW Control (Steel's Many-One Rank Test, 1-tailed, P=0.05)

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Toxicity Test Report: TR1067/4

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % non-immobilised	□90.0%	95.0%	Yes
Reference Toxicant within cusum chart limits	150.8-359.8mg KCl/L	212.1mg KCl/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 4 September 2013

Results are based on the samples in the condition as received by ESA.

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USEPA (2002) *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. 4th Ed.* United States Environmental Protection Agency, Office of Water, Washington DC.

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Statistical Printouts for the Acute Test with *Ceriodaphnia dubia*

Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	25/07/2013 13:30	Test ID:	PR1067/02	Sample ID:	GRT7000
End Date:	27/07/2013 16:30	Lab ID:	6153	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-mg/L	1	2	3	4
DMW Control	1.0000	0.8000	1.0000	1.0000
6.3	1.0000	1.0000	0.8000	0.8000
12.5	0.4000	0.4000	0.2000	0.4000
25	0.4000	0.2000	0.2000	0.2000
50	0.2000	0.2000	0.2000	0.0000
100	0.2000	0.2000	0.2000	0.2000
200	0.0000	0.2000	0.0000	0.0000
400	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
DMW Control	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4			1	20
6.3	0.9000	0.9474	1.2262	1.1071	1.3453	11.212	4	16.00	10.00	2	20
*12.5	0.3500	0.3684	0.6295	0.4636	0.6847	17.561	4	10.00	10.00	13	20
*25	0.2500	0.2632	0.5189	0.4636	0.6847	21.301	4	10.00	10.00	15	20
*50	0.1500	0.1579	0.4041	0.2255	0.4636	29.464	4	10.00	10.00	17	20
*100	0.2000	0.2105	0.4636	0.4636	0.4636	0.000	4	10.00	10.00	16	20
*200	0.0500	0.0526	0.2850	0.2255	0.4636	41.771	4	10.00	10.00	19	20
400	0.0000	0.0000	0.2255	0.2255	0.2255	0.000	4			20	20

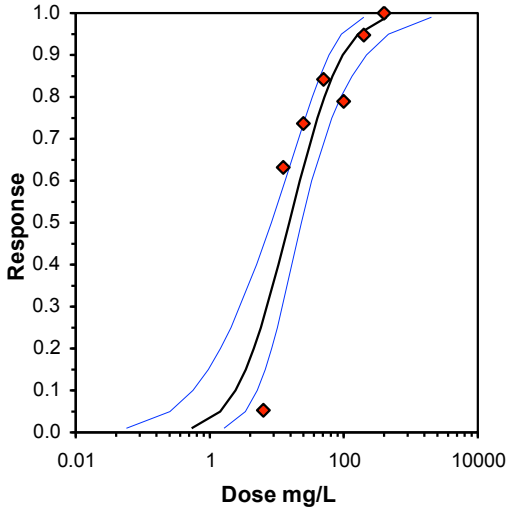
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.943974	0.924	-0.21673	-0.55042
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	6.3	12.5	8.87412	
Treatments vs DMW Control				

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	1.598792	0.286495	1.037261	2.160322	0.05	10.78142	11.0705	0.06	1.183813	0.625472	5
Intercept	3.107329	0.439457	2.245993	3.968665							
TSCR	0.042065	0.0448	-0.04574	0.129873							

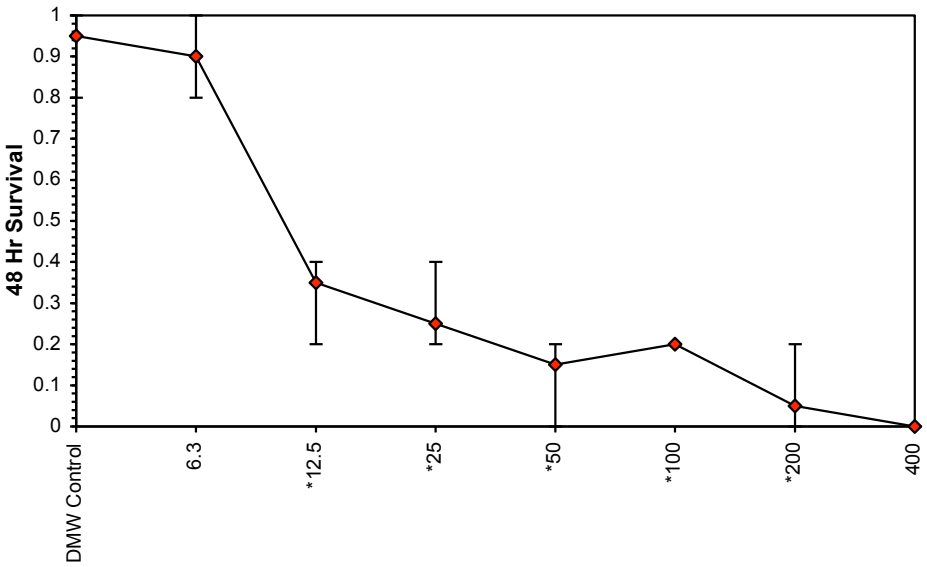
Point	Probits	mg/L	95% Fiducial Limits	
EC01	2.674	0.535485	0.056912	1.62042
EC05	3.355	1.428903	0.253709	3.411666
EC10	3.718	2.411228	0.55994	5.10014
EC15	3.964	3.432044	0.951909	6.712819
EC20	4.158	4.543625	1.447	8.375741
EC25	4.326	5.780143	2.066528	10.15646
EC40	4.747	10.60112	4.975828	16.82971
EC50	5.000	15.26909	8.250944	23.33229
EC60	5.253	21.99251	13.27745	33.33232
EC75	5.674	40.33554	26.59053	66.40661
EC80	5.842	51.3126	33.83948	90.3663
EC85	6.036	67.93188	43.96989	131.9065
EC90	6.282	96.69146	59.87371	216.7513
EC95	6.645	163.1637	92.20217	464.3851
EC99	7.326	435.3911	199.2022	2017.43



Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	25/07/2013 13:30	Test ID:	PR1067/02	Sample ID:	GRT7000
End Date:	27/07/2013 16:30	Lab ID:	6153	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	25/07/2013 13:30	Test ID:	PR1067/02	Sample ID:	GRT7000
End Date:	27/07/2013 16:30	Lab ID:	6153	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Auxiliary Data Summary

Conc-mg/L	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	95.00	80.00	100.00	10.00	3.33	4
6.3		90.00	80.00	100.00	11.55	3.78	4
12.5		35.00	20.00	40.00	10.00	9.04	4
25		25.00	20.00	40.00	10.00	12.65	4
50		15.00	0.00	20.00	10.00	21.08	4
100		20.00	20.00	20.00	0.00	0.00	4
200		5.00	0.00	20.00	10.00	63.25	4
400		0.00	0.00	0.00	0.00		4
DMW Control	pH	8.30	8.30	8.30	0.00	0.00	1
6.3		8.30	8.30	8.30	0.00	0.00	1
12.5		8.20	8.20	8.20	0.00	0.00	1
25		8.20	8.20	8.20	0.00	0.00	1
50		8.20	8.20	8.20	0.00	0.00	1
100		8.20	8.20	8.20	0.00	0.00	1
200		8.20	8.20	8.20	0.00	0.00	1
400		8.20	8.20	8.20	0.00	0.00	1
DMW Control	DO %	104.10	104.10	104.10	0.00	0.00	1
6.3		103.80	103.80	103.80	0.00	0.00	1
12.5		103.50	103.50	103.50	0.00	0.00	1
25		103.80	103.80	103.80	0.00	0.00	1
50		103.40	103.40	103.40	0.00	0.00	1
100		102.70	102.70	102.70	0.00	0.00	1
200		103.20	103.20	103.20	0.00	0.00	1
400		103.40	103.40	103.40	0.00	0.00	1
DMW Control	Cond uS/cm	166.30	166.30	166.30	0.00	0.00	1
6.3		166.20	166.20	166.20	0.00	0.00	1
12.5		166.20	166.20	166.20	0.00	0.00	1
25		166.40	166.40	166.40	0.00	0.00	1
50		166.80	166.80	166.80	0.00	0.00	1
100		167.00	167.00	167.00	0.00	0.00	1
200		167.70	167.70	167.70	0.00	0.00	1
400		168.90	168.90	168.90	0.00	0.00	1

Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	25/07/2013 13:30	Test ID:	PR1067/03	Sample ID:	GRT8000/9000
End Date:	27/07/2013 16:30	Lab ID:	6154	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-mg/L	1	2	3	4
DMW Control	1.0000	0.8000	1.0000	1.0000
6.3	0.8000	1.0000	1.0000	1.0000
12.5	1.0000	0.8000	1.0000	1.0000
25	1.0000	1.0000	1.0000	1.0000
50	1.0000	0.8000	1.0000	1.0000
100	0.8000	0.8000	0.6000	1.0000
200	0.8000	0.6000	0.4000	0.8000
400	0.4000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
DMW Control	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4				1	20
6.3	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	0.000	2.480	0.2673	1	20
12.5	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	0.000	2.480	0.2673	1	20
25	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	4	-0.552	2.480	0.2673	0	20
50	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	0.000	2.480	0.2673	1	20
100	0.8000	0.8421	1.1114	0.8861	1.3453	16.874	4	1.618	2.480	0.2673	4	20
*200	0.6500	0.6842	0.9463	0.6847	1.1071	21.467	4	3.150	2.480	0.2673	7	20
*400	0.1000	0.1053	0.3403	0.2255	0.6847	67.468	4	8.772	2.480	0.2673	18	20

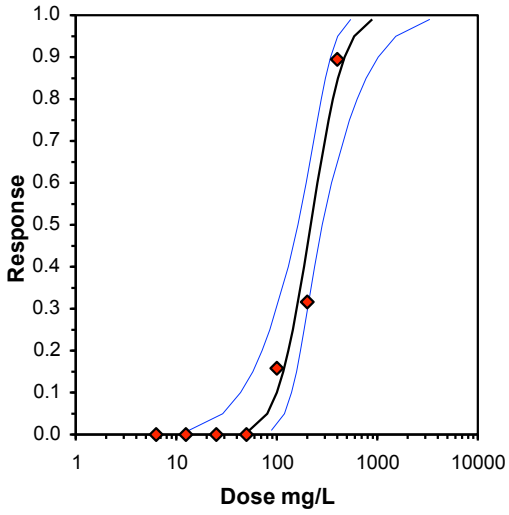
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.930261	0.93	0.108713	0.367174
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	200	141.4214		0.196213	0.213061	0.456073	0.023232	1.7E-08	7, 24
Treatments vs DMW Control										

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	3.804375	0.936228	1.969368	5.639383	0.05	3.14241	11.0705	0.68	2.33665	0.262855	4
Intercept	-3.88949	2.199414	-8.20034	0.42136							
TSCR	0.040657	0.020598	0.000284	0.081029							

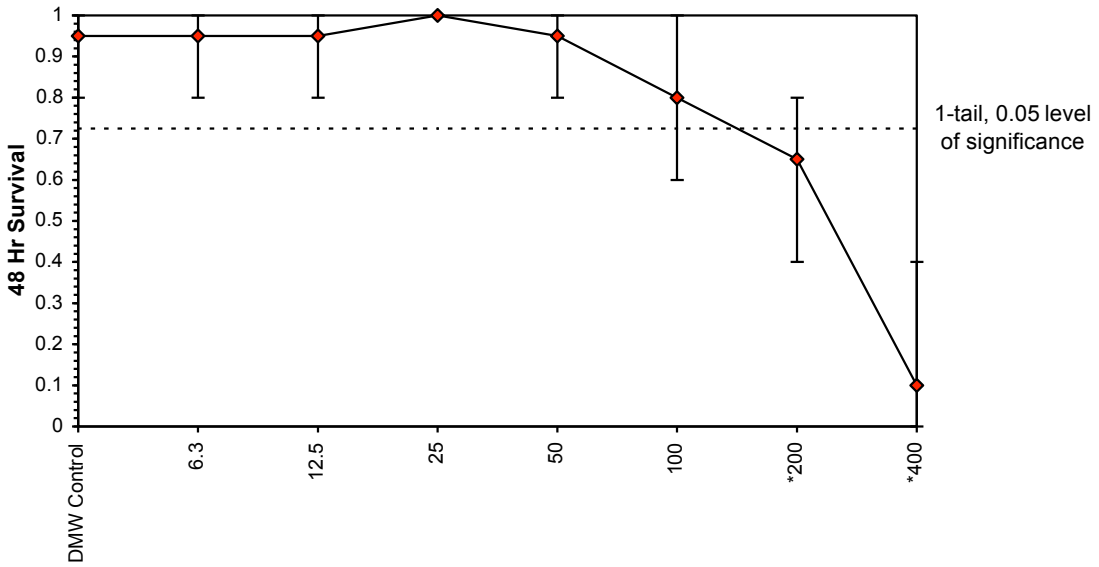
Point	Probits	mg/L	95% Fiducial Limits	
EC01	2.674	53.10762	13.28345	88.54745
EC05	3.355	80.22157	29.0127	118.7932
EC10	3.718	99.95097	43.75694	139.7112
EC15	3.964	115.9358	57.49923	156.5118
EC20	4.158	130.4443	71.16877	171.9435
EC25	4.326	144.3299	85.12237	187.1258
EC40	4.747	186.2327	129.9789	238.1386
EC50	5.000	217.0949	162.4361	284.1769
EC60	5.253	253.0715	196.5812	350.1852
EC75	5.674	326.5447	253.981	526.7007
EC80	5.842	361.3051	277.3273	627.8769
EC85	6.036	406.5196	305.4929	775.0545
EC90	6.282	471.5329	342.9924	1016.201
EC95	6.645	587.5	404.18	1529.636
EC99	7.326	887.4469	543.1836	3335.103



Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	25/07/2013 13:30	Test ID:	PR1067/03	Sample ID:	GRT8000/9000
End Date:	27/07/2013 16:30	Lab ID:	6154	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	25/07/2013 13:30	Test ID:	PR1067/03	Sample ID:	GRT8000/9000
End Date:	27/07/2013 16:30	Lab ID:	6154	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Auxiliary Data Summary

Conc-mg/L	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	95.00	80.00	100.00	10.00	3.33	4
6.3		95.00	80.00	100.00	10.00	3.33	4
12.5		95.00	80.00	100.00	10.00	3.33	4
25		100.00	100.00	100.00	0.00	0.00	4
50		95.00	80.00	100.00	10.00	3.33	4
100		80.00	60.00	100.00	16.33	5.05	4
200		65.00	40.00	80.00	19.15	6.73	4
400		10.00	0.00	40.00	20.00	44.72	4
DMW Control	pH	8.30	8.30	8.30	0.00	0.00	1
6.3		8.20	8.20	8.20	0.00	0.00	1
12.5		8.20	8.20	8.20	0.00	0.00	1
25		8.20	8.20	8.20	0.00	0.00	1
50		8.20	8.20	8.20	0.00	0.00	1
100		8.20	8.20	8.20	0.00	0.00	1
200		8.20	8.20	8.20	0.00	0.00	1
400		8.20	8.20	8.20	0.00	0.00	1
DMW Control	DO %	104.10	104.10	104.10	0.00	0.00	1
6.3		103.90	103.90	103.90	0.00	0.00	1
12.5		103.50	103.50	103.50	0.00	0.00	1
25		103.60	103.60	103.60	0.00	0.00	1
50		103.90	103.90	103.90	0.00	0.00	1
100		103.50	103.50	103.50	0.00	0.00	1
200		103.60	103.60	103.60	0.00	0.00	1
400		103.30	103.30	103.30	0.00	0.00	1
DMW Control	Cond uS/cm	166.30	166.30	166.30	0.00	0.00	1
6.3		166.30	166.30	166.30	0.00	0.00	1
12.5		166.20	166.20	166.20	0.00	0.00	1
25		166.30	166.30	166.30	0.00	0.00	1
50		166.40	166.40	166.40	0.00	0.00	1
100		166.70	166.70	166.70	0.00	0.00	1
200		167.10	167.10	167.10	0.00	0.00	1
400		167.80	167.80	167.80	0.00	0.00	1

Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	22/08/2013 14:00	Test ID:	PR1067/05	Sample ID:	Soil stabilised with GRT7000
End Date:	24/08/2013 13:30	Lab ID:	6198	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-g/L	1	2	3	4
DMW Control	0.8000	1.0000	1.0000	1.0000
WAF Control	1.0000	1.0000	1.0000	1.0000
6.3	1.0000	1.0000	1.0000	1.0000
12.5	1.0000	1.0000	1.0000	1.0000
25	0.8000	0.6000	1.0000	0.8000
50	0.2000	0.6000	0.8000	1.0000
100	0.6000	0.8000	0.6000	0.2000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-g/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
DMW Control	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4				
WAF Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*		0	20
6.3	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
12.5	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
25	0.8000	0.8000	1.1114	0.8861	1.3453	16.874	4	12.00	10.00	4	20
50	0.6500	0.6500	0.9505	0.4636	1.3453	39.437	4	12.00	10.00	7	20
*100	0.5500	0.5500	0.8357	0.4636	1.1071	32.195	4	10.00	10.00	9	20

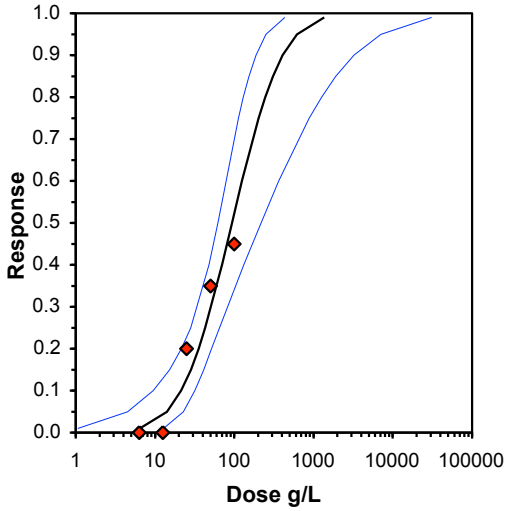
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.813898	0.916	-0.65398	2.565492
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.36)	1	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	50	100	70.71068	
Treatments vs WAF Control				

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	2.00252	0.484324	1.053244	2.951796	0	2.772409	7.814728	0.43	1.970364	0.499371	6
Intercept	1.054307	0.812351	-0.5379	2.646515							
TSCR											

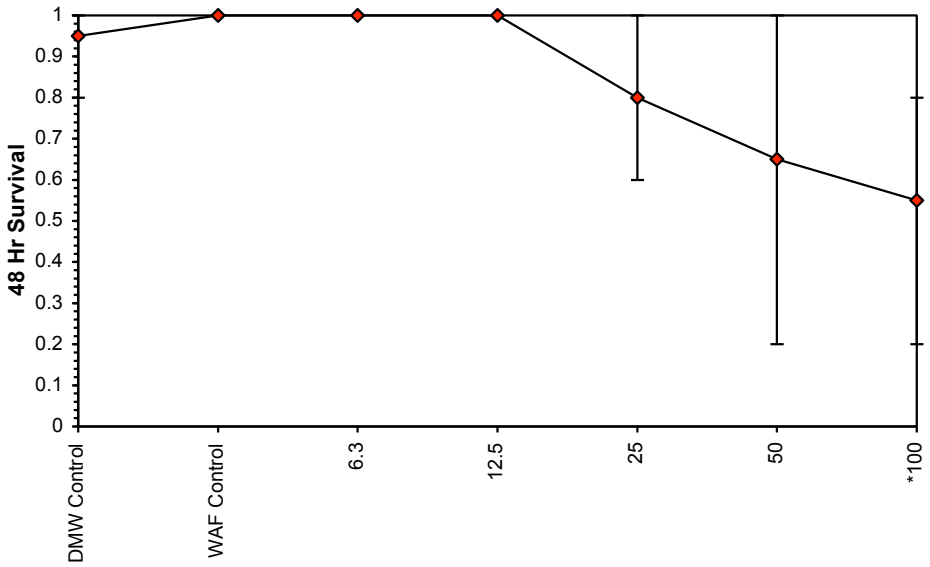
Point	Probits	g/L	95% Fiducial Limits	
EC01	2.674	6.436556	1.059958	12.838
EC05	3.355	14.09198	4.499502	22.83176
EC10	3.718	21.39905	9.45867	31.90718
EC15	3.964	28.36608	15.1909	41.10572
EC20	4.158	35.4881	21.4939	51.77644
EC25	4.326	43.00742	28.08547	65.05321
EC40	4.747	69.79908	48.11054	132.4453
EC50	5.000	93.40366	62.29697	216.8591
EC60	5.253	124.9908	78.76527	363.6452
EC75	5.674	202.8544	113.3646	881.1738
EC80	5.842	245.8357	130.3548	1258.099
EC85	6.036	307.5591	153.0773	1909.382
EC90	6.282	407.693	186.9448	3234.873
EC95	6.645	619.0928	250.5966	7089.411
EC99	7.326	1355.421	431.5675	31078.12



Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	22/08/2013 14:00	Test ID:	PR1067/05	Sample ID:	Soil stabilised with GRT7000
End Date:	24/08/2013 13:30	Lab ID:	6198	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	22/08/2013 14:00	Test ID:	PR1067/05	Sample ID:	Soil stabilised with GRT7000
End Date:	24/08/2013 13:30	Lab ID:	6198	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Auxiliary Data Summary

Conc-g/L	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	95.00	80.00	100.00	10.00	3.33	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
6.3		100.00	100.00	100.00	0.00	0.00	4
12.5		100.00	100.00	100.00	0.00	0.00	4
25		80.00	60.00	100.00	16.33	5.05	4
50		65.00	20.00	100.00	34.16	8.99	4
100		55.00	20.00	80.00	25.17	9.12	4
DMW Control	pH	8.00	8.00	8.00	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
6.3		8.10	8.10	8.10	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.10	8.10	8.10	0.00	0.00	1
100		8.00	8.00	8.00	0.00	0.00	1
DMW Control	DO %	97.00	97.00	97.00	0.00	0.00	1
WAF Control		96.30	96.30	96.30	0.00	0.00	1
6.3		98.00	98.00	98.00	0.00	0.00	1
12.5		97.90	97.90	97.90	0.00	0.00	1
25		97.80	97.80	97.80	0.00	0.00	1
50		96.90	96.90	96.90	0.00	0.00	1
100		96.00	96.00	96.00	0.00	0.00	1
DMW Control	Cond uS/cm	170.70	170.70	170.70	0.00	0.00	1
WAF Control		170.30	170.30	170.30	0.00	0.00	1
6.3		170.80	170.80	170.80	0.00	0.00	1
12.5		171.70	171.70	171.70	0.00	0.00	1
25		174.40	174.40	174.40	0.00	0.00	1
50		179.30	179.30	179.30	0.00	0.00	1
100		169.50	169.50	169.50	0.00	0.00	1

Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	22/08/2013 14:00	Test ID:	PR1067/06	Sample ID:	Soil stabilised with GRT8000/9000
End Date:	24/08/2013 13:30	Lab ID:	6199	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-g/L	1	2	3	4
DMW Control	0.8000	1.0000	1.0000	1.0000
WAF Control	1.0000	1.0000	1.0000	1.0000
6.3	1.0000	1.0000	1.0000	1.0000
12.5	0.4000	0.4000	0.0000	0.4000
25	0.2000	0.0000	0.2000	0.0000
50	0.0000	0.2000	0.0000	0.0000
100	0.0000	0.2000	0.2000	0.4000

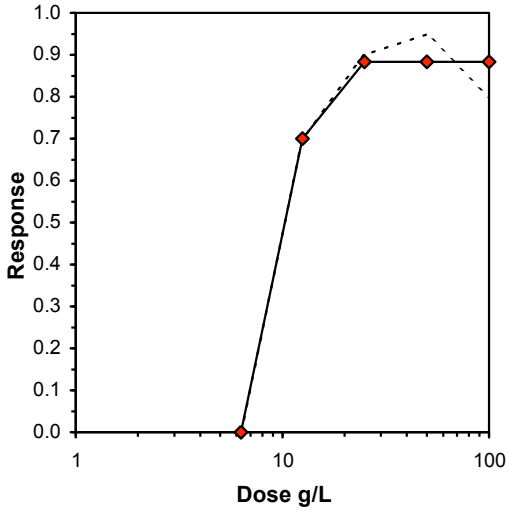
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-g/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
DMW Control	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4				
WAF Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*		0	20
6.3	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	0	20
*12.5	0.3000	0.3000	0.5699	0.2255	0.6847	40.287	4	10.00	10.00	14	20
*25	0.1000	0.1000	0.3446	0.2255	0.4636	39.900	4	10.00	10.00	18	20
*50	0.0500	0.0500	0.2850	0.2255	0.4636	41.771	4	10.00	10.00	19	20
*100	0.2000	0.2000	0.4594	0.2255	0.6847	40.823	4	10.00	10.00	16	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.914189	0.916	-0.78011	1.559183
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.36)	1	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	6.3	12.5	8.87412	
Treatments vs WAF Control				

Trimmed Spearman-Karber

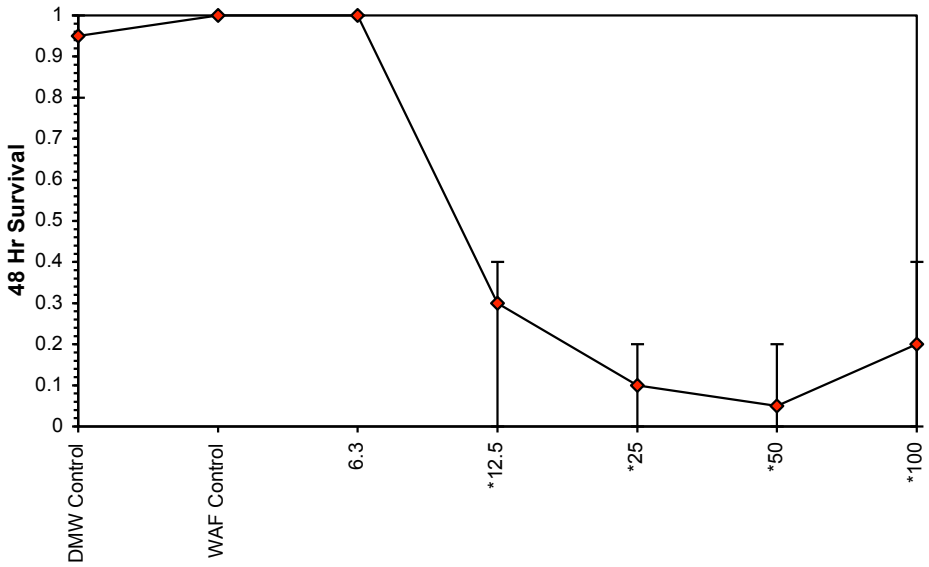
Trim Level	EC50	95% CL	
0.0%			
5.0%			
10.0%			
20.0%	10.520	8.427	13.134
Auto-11.7%	10.929	8.968	13.318



Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	22/08/2013 14:00	Test ID:	PR1067/06	Sample ID:	Soil stabilised with GRT8000/9000
End Date:	24/08/2013 13:30	Lab ID:	6199	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	22/08/2013 14:00	Test ID:	PR1067/06	Sample ID:	Soil stabilised with GRT8000/9000
End Date:	24/08/2013 13:30	Lab ID:	6199	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Auxiliary Data Summary

Conc-g/L	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	95.00	80.00	100.00	10.00	3.33	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
6.3		100.00	100.00	100.00	0.00	0.00	4
12.5		30.00	0.00	40.00	20.00	14.91	4
25		10.00	0.00	20.00	11.55	33.98	4
50		5.00	0.00	20.00	10.00	63.25	4
100		20.00	0.00	40.00	16.33	20.21	4
DMW Control	pH	8.00	8.00	8.00	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
6.3		8.10	8.10	8.10	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.10	8.10	8.10	0.00	0.00	1
100		8.10	8.10	8.10	0.00	0.00	1
DMW Control	DO %	97.00	97.00	97.00	0.00	0.00	1
WAF Control		96.30	96.30	96.30	0.00	0.00	1
6.3		97.30	97.30	97.30	0.00	0.00	1
12.5		97.10	97.10	97.10	0.00	0.00	1
25		96.60	96.60	96.60	0.00	0.00	1
50		96.00	96.00	96.00	0.00	0.00	1
100		95.50	95.50	95.50	0.00	0.00	1
DMW Control	Cond uS/cm	170.70	170.70	170.70	0.00	0.00	1
WAF Control		170.30	170.30	170.30	0.00	0.00	1
6.3		170.60	170.60	170.60	0.00	0.00	1
12.5		172.40	172.40	172.40	0.00	0.00	1
25		176.20	176.20	176.20	0.00	0.00	1
50		184.00	184.00	184.00	0.00	0.00	1
100		186.00	186.00	186.00	0.00	0.00	1

Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	22/08/2013 14:00	Test ID:	PR1067/06	Sample ID:	Soil stabilised with GRT8000/9000
End Date:	24/08/2013 13:30	Lab ID:	6199	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-g/L	1	2	3	4
DMW Control	0.8000	1.0000	1.0000	1.0000
WAF Control	1.0000	1.0000	1.0000	1.0000
6.3	1.0000	1.0000	1.0000	1.0000
12.5	0.4000	0.4000	0.0000	0.4000
25	0.2000	0.0000	0.2000	0.0000
50	0.0000	0.2000	0.0000	0.0000
100	0.0000	0.2000	0.2000	0.4000

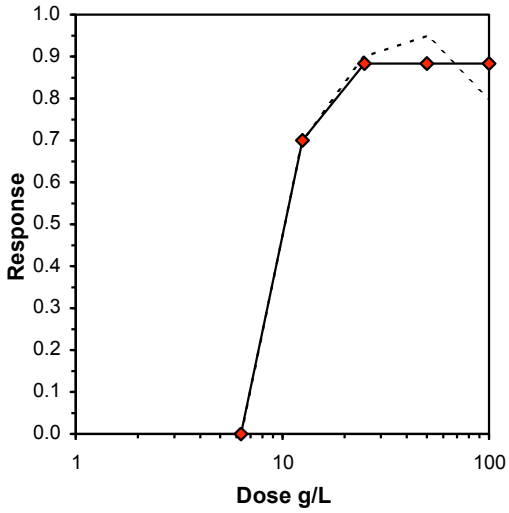
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-g/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
DMW Control	0.9500	0.9500	1.2857	1.1071	1.3453	9.261	4				
WAF Control	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	*		1.0000	1.0000
6.3	1.0000	1.0000	1.3453	1.3453	1.3453	0.000	4	18.00	10.00	1.0000	1.0000
*12.5	0.3000	0.3000	0.5699	0.2255	0.6847	40.287	4	10.00	10.00	0.3000	0.3000
*25	0.1000	0.1000	0.3446	0.2255	0.4636	39.900	4	10.00	10.00	0.1167	0.1167
*50	0.0500	0.0500	0.2850	0.2255	0.4636	41.771	4	10.00	10.00	0.1167	0.1167
*100	0.2000	0.2000	0.4594	0.2255	0.6847	40.823	4	10.00	10.00	0.1167	0.1167

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.914189	0.916	-0.78011	1.559183
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.36)	1	2.446912		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	6.3	12.5	8.87412	
Treatments vs WAF Control				

Log-Logit Interpolation (200 Resamples)

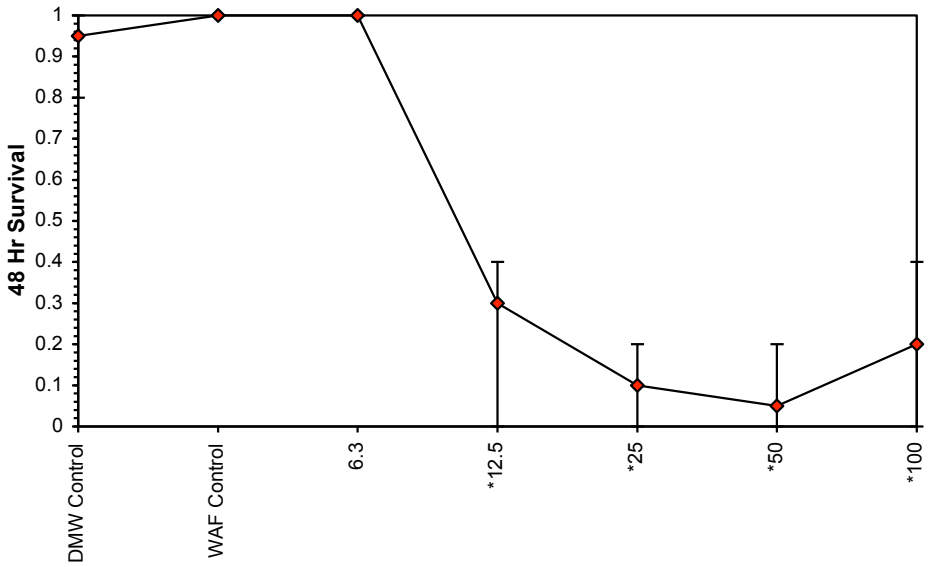
Point	g/L	SD	95% CL(Exp)		Skew
IC05	9.707	0.181	8.948	10.011	-0.8198
IC10	10.207	0.211	9.320	10.564	-0.8149
IC15	10.529	0.232	9.558	10.920	-0.8119
IC20	10.777	0.247	9.740	11.196	-0.8097
IC25	10.986	0.261	9.893	11.428	-0.8078
IC40	11.505	0.295	10.270	12.006	-0.8034
IC50	11.819	0.317	10.497	12.356	-0.8007



Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	22/08/2013 14:00	Test ID:	PR1067/06	Sample ID:	Soil stabilised with GRT8000/9000
End Date:	24/08/2013 13:30	Lab ID:	6199	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Dose-Response Plot



Ceriodaphnia Acute Toxicity Test-48 Hr Survival

Start Date:	22/08/2013 14:00	Test ID:	PR1067/06	Sample ID:	Soil stabilised with GRT8000/9000
End Date:	24/08/2013 13:30	Lab ID:	6199	Sample Type:	WAF-Water Accommodated Fraction
Sample Date:		Protocol:	ESA 101	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Auxiliary Data Summary

Conc-g/L	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	95.00	80.00	100.00	10.00	3.33	4
WAF Control		100.00	100.00	100.00	0.00	0.00	4
6.3		100.00	100.00	100.00	0.00	0.00	4
12.5		30.00	0.00	40.00	20.00	14.91	4
25		10.00	0.00	20.00	11.55	33.98	4
50		5.00	0.00	20.00	10.00	63.25	4
100		20.00	0.00	40.00	16.33	20.21	4
DMW Control	pH	8.00	8.00	8.00	0.00	0.00	1
WAF Control		8.10	8.10	8.10	0.00	0.00	1
6.3		8.10	8.10	8.10	0.00	0.00	1
12.5		8.10	8.10	8.10	0.00	0.00	1
25		8.10	8.10	8.10	0.00	0.00	1
50		8.10	8.10	8.10	0.00	0.00	1
100		8.10	8.10	8.10	0.00	0.00	1
DMW Control	DO %	97.00	97.00	97.00	0.00	0.00	1
WAF Control		96.30	96.30	96.30	0.00	0.00	1
6.3		97.30	97.30	97.30	0.00	0.00	1
12.5		97.10	97.10	97.10	0.00	0.00	1
25		96.60	96.60	96.60	0.00	0.00	1
50		96.00	96.00	96.00	0.00	0.00	1
100		95.50	95.50	95.50	0.00	0.00	1
DMW Control	Cond uS/cm	170.70	170.70	170.70	0.00	0.00	1
WAF Control		170.30	170.30	170.30	0.00	0.00	1
6.3		170.60	170.60	170.60	0.00	0.00	1
12.5		172.40	172.40	172.40	0.00	0.00	1
25		176.20	176.20	176.20	0.00	0.00	1
50		184.00	184.00	184.00	0.00	0.00	1
100		186.00	186.00	186.00	0.00	0.00	1

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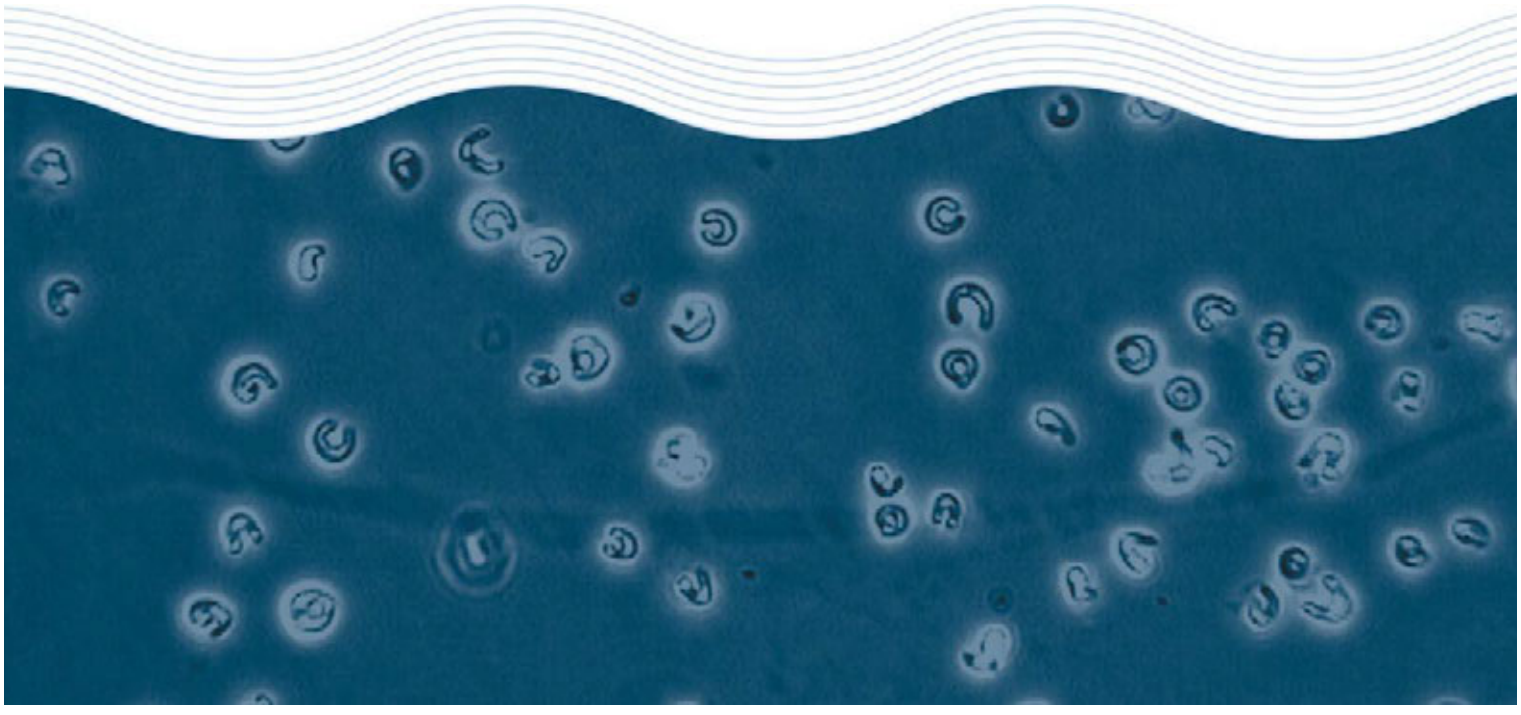
SERVICES AUSTRALASIA

Toxicity Assessment of GRT7000 and GRT8000/9000

ERM

Test Report

April 2014



Toxicity Assessment of GRT7000 and GRT8000/9000

ERM

Test Report

April 2014

ECOTOX Services Australasia Pty Ltd ABN>45 094 714 904
unit 27/2 chaplin drive lane cove nsw 2066 T>61 2 9420 9481 F>61 2 9420 9484 W>www.ecotox.com.au

Toxicity Test Report: TR1097/01

This document is issued in accordance with NATA's accreditation requirements

Client:	ERM Building C, 33 Saunders Street Pyrmont NSW 2009	**ESA Job #:** **Date Sampled:** **Date Received:** **Sampled By:**	PR1097 07 March 2014 10 March 2014 Client
Attention:	Olivia Patterson	**ESA Quote #:**	PL1097_q01

Lab ID No.:	Sample Name:	Sample Description:
6520	GRT7000	Chemical received at room temperature in apparent good condition
6521	GRT8000/9000	Chemical received at room temperature in apparent good condition

Test Performed:	96-hr fish imbalance toxicity test using the eastern rainbowfish *Melanotaenia splendida splendida*
Test Protocol:	ESA SOP 117 (ESA 2013), based on USEPA (2002)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The highest test concentrations were prepared by adding either sample 6520 "GRT7000" or sample 6521 "GRT8000/9000" into dilute mineral water (DMW). The remaining test concentrations were achieved by serially diluting the highest test concentrations with DMW. A DMW control was tested concurrently with the prepared samples.
Source of Test Organisms:	In-house cultures
Test Initiated:	21 March 2014 at 1400h

Sample 6520: *GRT7000*		Sample 6521: *GRT8000/9000*		*Vacant*
Concentration (mg/L)	**% Unaffected (Mean ± SD)**	**Concentration (mg/L)**	**% Unaffected (Mean ± SD)**	
DMW Control	95.0 ± 10.0	DMW Control	95.0 ± 10.0	
62.5	95.0 ± 10.0	62.5	90.0 ± 11.6	
125.0	100 ± 0.0	125.0	95.0 ± 10.0	
250.0	90.0 ± 20.0	250.0	95.0 ± 10.0	
500.0	95.0 ± 10.0	500.0	95.0 ± 10.0	
1000.0	100 ± 0.0	1000.0	100 ± 0.0	
96-hr EC10 = >1000mg/L		**96-hr EC10 = >1000mg/L**		
96-hr EC50 = >1000mg/L		**96-hr EC50 = >1000mg/L**		
NOEC =1000mg/L		**NOEC =1000mg/L**		
LOEC = >1000mg/L		**LOEC = >1000mg/L**		

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % unaffected	≥80.0%	95.0%	Yes
Reference Toxicant within cusum chart limits	5.3-78.5µg Cu/L	12.5µg Cu/L	Yes

Toxicity Test Report: TR1097/1

Test Report Authorised by: Dr Rick Krassoi, Director on 11 April 2014

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

ESA (2013) SOP 117 – *Freshwater and Marine Fish Imbalance Test*. Issue No 10. Ecotox Services Australasia, Sydney, NSW

USEPA (2002) Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms. Fifth edition EPA-821-R-02-012. United States Environmental Protection Agency, Office of Research and Development, Washington FC, USA

Toxicity Test Report: TR1097/2

This document is issued in accordance with NATA's accreditation requirements

Client:	ERM Building C, 33 Saunders Street Pyrmont NSW 2009	**ESA Job #:** **Date Sampled:** **Date Received:** **Sampled By:**	PR1097 07 March 2014 10 March 2014 Client
Attention:	Olivia Patterson	**ESA Quote #:**	PL1097_q01

Lab ID No.:	Sample Name:	Sample Description:
6520	GRT7000	Chemical received at room temperature in apparent good condition
6521	GRT8000/9000	Chemical received at room temperature in apparent good condition

Test Performed:	96-hr acute survival test using the freshwater shrimp *Paratya australiensis*
Test Protocol:	ESA SOP 123 (ESA 2012), based on USEPA (1996)
Test Temperature:	The test was performed at 20±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The highest test concentrations were prepared by adding either sample 6520 "GRT7000" or sample 6521 "GRT8000/9000" into dilute mineral water (DMW). The remaining test concentrations were achieved by serially diluting the highest test concentrations with DMW. A DMW control was tested concurrently with the prepared samples.
Source of Test Organisms:	Hatchery reared, QLD
Test Initiated:	25 March 2014 at 1515h

Sample 6520: *GRT7000*		Sample 6521: *GRT8000/9000*		*Vacant*
Concentration (mg/L)	**% Unaffected (Mean ± SD)**	**Concentration (mg/L)**	**% Unaffected (Mean ± SD)**	
DMW Control	90.0 ± 11.6	DMW Control	90.0 ± 11.6	
62.5	100 ± 0.0	62.5	95.0 ± 10.0	
125.0	85.0 ± 19.2	125.0	100 ± 0.0	
250.0	100 ± 0.0	250.0	90.0 ± 11.6	
500.0	95.0 ± 10.0	500.0	95.8 ± 8.3	
1000.0	76.7 ± 17.6	1000.0	100 ± 0.0	
96-hr EC10 = 750.5mg/L*		**96-hr EC10 = >1000mg/L**		
96-hr EC50 = >1000mg/L		**96-hr EC50 = >1000mg/L**		
NOEC = 1000mg/L		**NOEC = 1000mg/L**		
LOEC = >1000mg/L		**LOEC = >1000mg/L**		

*95% confidence limits not available

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean % unaffected	≥90.0%	90.0%	Yes
Reference Toxicant within cusum chart limits	51.5-647.6µg Cu/L	264.7µg Cu/L	Yes

Toxicity Test Report: TR1097/2

Test Report Authorised by: Dr Rick Krassoi, Director on 11 April 2014

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

ESA (2012) SOP 123 –*Acute Toxicity Test Using Freshwater Shrimp.* Issue No 2. Ecotox Services Australasia, Sydney, NSW

USEPA (1996) Ecological Effects Test Guidelines: OPPTS 850.1035 Mysid Acute Toxicity Test. Public Draft. United States Environmental Protection Agency, Washington DC, USA.

Toxicity Test Report: TR1097/3

This document is issued in accordance with NATA's accreditation requirements

Client:	ERM Building C, 33 Saunders Street Pyrmont NSW 2009	**ESA Job #:** **Date Sampled:** **Date Received:**	PR1097 07 March 2014 10 March 2014
Attention:	Olivia Patterson	**Sampled By:**	Client
Client Ref:	Not supplied	**ESA Quote #:**	PL1097_q01

Lab ID No.:	Sample Name:	Sample Description:
6520	GRT7000	Chemical received at room temperature in apparent good condition
6521	GRT8000/9000	Chemical received at room temperature in apparent good condition

Test Performed:	7-day Growth inhibition of the freshwater aquatic duckweed *Lemna disperma*
Test Protocol:	ESA SOP 112 (ESA 2012), based on OECD method 221 (2006)
Test Temperature:	The test was performed at 25±2°C.
Deviations from Protocol:	The test vials were randomised daily
Comments on Solution Preparation:	The highest test concentrations were prepared by adding either sample 6520 "GRT7000" or sample 6521 "GRT8000/9000" into Swedish standard medium (SIS). The remaining test concentrations were achieved by serially diluting the highest test concentrations with SIS media. A SIS control was tested concurrently with the prepared samples.
Source of Test Organisms:	ESA Laboratory culture
Test Initiated:	28 March 2014 at 1330h

Sample 6520: *GRT7000*		Sample 6521: *GRT8000/9000*		*Vacant*
Concentration (mg/L)	**Specific Growth Rate (Mean ± SD)**	**Concentration (mg/L)**	**Specific Growth Rate (Mean ± SD)**	
SIS Control	0.28 ± 0.01	SIS Control	0.28 ± 0.01	
62.5	0.27 ± 0.01	62.5	0.28 ± 0.02	
125.0	0.27 ± 0.02	125.0	0.26 ± 0.01	
250.0	0.27 ± 0.03	250.0	0.26 ± 0.03	
500.0	0.27 ± 0.03	500.0	0.27 ± 0.04	
1000.0	0.28 ± 0.02	1000.0	0.27 ± 0.03	
7 day IC10 = >1000mg/L		**7 day IC10 = >1000mg/L**		
7 day IC50 = >1000mg/L		**7 day IC50 = >1000mg/L**		
NOEC =1000mg/L		**NOEC =1000mg/L**		
LOEC = >1000mg/L		**LOEC =>1000mg/L**		

QA/QC Parameter	Criterion	This Test	Criterion met?
Control frond doubling time	<2.5 days	2.4 days	Yes
Reference Toxicant within cusum chart limits	2.3-6.5g KCl/L	3.6g KCl/L	Yes

Toxicity Test Report: TR1097/03

Test Report Authorised by: Dr Rick Krassoi, Director on 11 April 2014

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

Citations:

ESA (2012) *SOP 112 – Duckweed Growth Inhibition Test.* Issue No. 5. Ecotox Services Australasia, Sydney NSW

OECD (2006) *Lemna sp*. Growth Inhibition Test. Method 221. OECD Guideline for the Testing of Chemicals. Organisation for Economic Cooperation and Development, Paris

Toxicity Test Report: TR1097/04

This document is issued in accordance with NATA's accreditation requirements

Client:	ERM Building C, 33 Saunders Street Pyrmont NSW 2009	**ESA Job #:** **Date Sampled:** **Date Received:** **Sampled By:**	PR1097 07 March 2014 10 March 2014 Client
Attention:	Olivia Patterson	**ESA Quote #:**	PL1097_q01

Lab ID No.:	Sample Name:	Sample Description:
6520	GRT7000	Chemical received at room temperature in apparent good condition
6521	GRT8000/9000	Chemical received at room temperature in apparent good condition

Test Performed:	72-hr microalgal growth inhibition test using the green alga *Selenastrum capricornutum*
Test Protocol:	ESA SOP 103 (ESA 2013), based on USEPA (2002)
Test Temperature:	The test was performed at 25±1°C.
Deviations from Protocol:	Nil
Comments on Solution Preparation:	The highest test concentrations were prepared by adding either sample 6520 "GRT7000" or sample 6521 "GRT8000/9000" into USEPA media. The remaining test concentrations were achieved by serially diluting the highest test concentrations with USEPA media. A USEPA control was tested concurrently with the prepared samples.
Source of Test Organisms:	ESA Laboratory culture, originally sourced from CSIRO Microalgal Supply Service, TAS
Test Initiated:	21 March 2014 at 1530h

Sample 6520: *GRT7000*

Concentration (mg/L)	Cell Yield x10^4 cells/mL (Mean ± SD)
USEPA Control	15.6 ± 0.7
Colour Control	10.9 ± 1.0 *
62.5	13.9 ± 2.2
125.0	14.6 ± 1.3
250.0	15.3 ± 2.9
500.0	15.7 ± 2.9
1000.0	12.3 ± 1.7**

72-hr IC10 = 661.6mg/L***
72-hr IC50 = >1000mg/L
NOEC = 500mg/L
LOEC = 1000mg/L

Sample 6521: *GRT8000/9000*

Concentration (mg/L)	Cell Yield x10^4 cells/mL (Mean ± SD)
USEPA Control	15.6 ± 0.7
Colour Control	10.6 ± 0.9 *
62.5	13.9 ± 0.8
125.0	15.1 ± 2.0
250.0	14.6 ± 0.6
500.0	13.1 ± 2.5**
1000.0	11.4 ± 1.9**

72-hr IC10 = 335.4mg/L***
72-hr IC50 =>1000mg/L
NOEC = 250mg/L
LOEC = 500mg/L

*Significantly lower cell yield compared with the USEPA Control (Homoscedastic t Test, 1-tailed, P=0.05)
**Significantly lower cell yield compared with the USEPA Control (Bonferroni t Test, 1-tailed, P=0.05)
***95% confidence limits are not available

CHAIN – OF CUSTODY / SERVICE REQUEST FORM

Datasheet ID 601.1
Last Revised: 22 January 2013

Customer: ERM (Ref 02222833)
Contact Name: Olivia Patterson
Phone: 0285848894 Email: olivia.patterson@erm.com

Ship To: Ecotox Services Australia Pty Ltd, 27/2 Chaplin Dr, Lane Cove, NSW 2066
Attention: Rick Krassoi

Sample Date Day/Month/Year	Sample Time	Sample Name (Exactly as written on the sample vessel)	Sample Method (e.g Grab Composite etc)	Number and Volume of Containers (e.g 2 x 1L)	Test Requested (See Reverse for Guidance)						Comments / Instruction
					72 hour algal growth sc	7 Day Duckweed LD	96 hour Acute Shrimp	96 hour acute fish			**Note that testing will be delayed if an incomplete chain of custody is received** Additional treatment of samples (i.e. spiking) Subcontracted services (i.e chemical analyses) Dilutions required (if different than 100% down to 6.25%) Sample holding time restrcitions (if applicable) Sample used for litigation (if applicable) Note : An MSDS must be attached if Available ESA Project Number: PR
7/3/14		GRT 7000	Product	1 x 2L	✓	✓	✓	✓			Also, please use previously
7/3/14		GRT 8000 / 9000	Product	1 x 2L	✓	✓	✓	✓			Provided soils –crust up
											And send WAF to
											ALS Environmental
											277 – 289 Woodpark Road
											Sydney 2164

1) Released By: Olivia Patterson	2) Received By: Tina	3) Released By:	2) Received By:
Date: 10/03/14	Date:10/03/14	Date:	Date:
Of: ERM Time: 11:00 am	Of: ESA Time: 15:00	Of: Time:	Of: Time:

Note that the chain-of-custody documentation will provide definitive information on the tests to be performed.

Ecotox Services Australasia . Unit27, 2 Chaplin Drive, Lane Cove NSW 2066 AUSTRALIA
Phone: 61 2 9420-9481 Fax 61 2 9420-9484 1nfo@ecotox.com.au

Toxicity Test Report: TR1097/04

QA/QC Parameter	Criterion	This Test	Criterion met?
Control mean cell density	216.0x10^4 cells/mL	16.6x10^4 cells/mL	Yes
Control coefficient of variation	<20%	4.7%	Yes
Reference Toxicant within cusum chart limits	1.5-6.2g KCl/L	2.8g KCl/L	Yes

Test Report Authorised by: Dr Rick Krassoi, Director on 11 April 2014

Results are based on the samples in the condition as received by ESA.

NATA Accredited Laboratory Number: 14709

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Citations:

ESA (2013) *ESA SOP 103 – Green Alga, Selenastrum capricornutum, Growth Test*. Issue No 10. Ecotox Services Australasia, Sydney, NSW.

USEPA (2002) *Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms*. Fourth Edition. EPA-821-R-02-013. United States Environmental Protection Agency, Office of Research and Development, Washington DC, USA,

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Chain-of-Custody Documentation

Datasheet ID: 601.2
Last Revised: 30 April 2009

Sample Receipt Notification

Attention : Olivia Patterson

Client : ERM
Building C, 33 Saunders Street
Pyrmont NSW 2009

Email : olivia.patterson@erm.com
Telephone : 02 8584 8894
Facsimile :

Date : 12/03/2014

Re : Receipt of Samples **Pages : 2**

ESA Project : PL1097 ☑ For Review ☐ Additional Documentation Required - Please Respond

Sample Delivery Details

Completed Chain of Custody accompanied samples: **YES**
Samples received in apparent good condition and correctly bottled: **YES**
Security seals on sample bottles and esky intact: **YES**

Date samples received : 10/03/2014
Time samples received : 15:00
No. of samples received : 2
Sample matrix : Chemical
Sample temperature : room temperature

Comments : Includes 1x2L GRT7000 (ESA ID# 6520) and 1x2L GRT8/9000 (ESA ID# 6521)

Contact Details

Customer Services Officer : Tina Micevska
Telephone : 61 2 9420 9481
Facsimile : 61 2 9420 9484
Email : tmicevska@ecotox.com.au

Please contact customer services officer for all queries or issues regarding samples

Note that the chain-of-custody provides definitive information on the tests to be performed

Ecotox Services Australia
ABN 45 094 714 904
Unit 27, 2 Chaplin Drive
Lane Cove NSW 2066 Australia

Phone : 61 2 9420 9481
Fax : 61 2 9420 9484
Email : info@ecotox.com.au

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SERVICES AUSTRALASIA

Statistical Printouts for the Larval Fish Imbalance Tests

Fish Acute Toxicity Test-96 hr Imbalance

Start Date:	21/03/2014 14:00	Test ID:	PR1097/02	Sample ID:	GRT7000
End Date:	25/03/2014 14:00	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 117	Test Species:	MS-Melanotaenia splendida
Comments:					

Conc-mg/L	1	2	3	4
DMW Control	0.8000	1.0000	1.0000	1.0000
62.5	1.0000	1.0000	1.0000	0.8000
125	1.0000	1.0000	1.0000	1.0000
250	1.0000	0.6000	1.0000	1.0000
500	1.0000	1.0000	1.0000	0.8000
1000	1.0000	1.0000	1.0000	1.0000

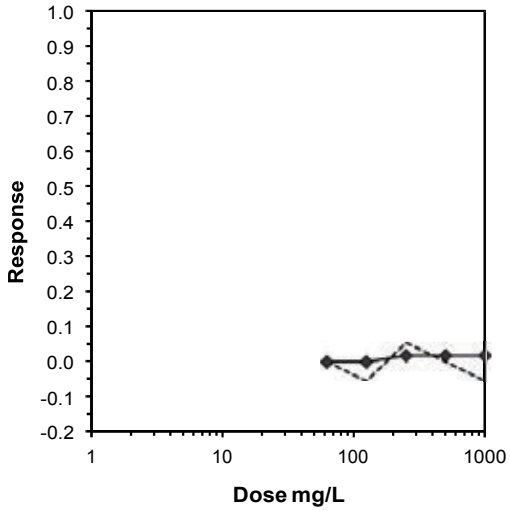
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
DMW Control	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4			0.9667	1.0000
62.5	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	18.00	10.00	0.9667	1.0000
125	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	4	20.00	10.00	0.9667	1.0000
250	0.9000	0.9474	1.2305	0.8861	1.3453	18.660	4	17.50	10.00	0.9500	0.9828
500	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	18.00	10.00	0.9500	0.9828
1000	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	4	20.00	10.00	0.9500	0.9828

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.762065	0.916	-1.76412	3.060606
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	1000	>1000		
Treatments vs DMW Control				

Log-Logit Interpolation (200 Resamples)

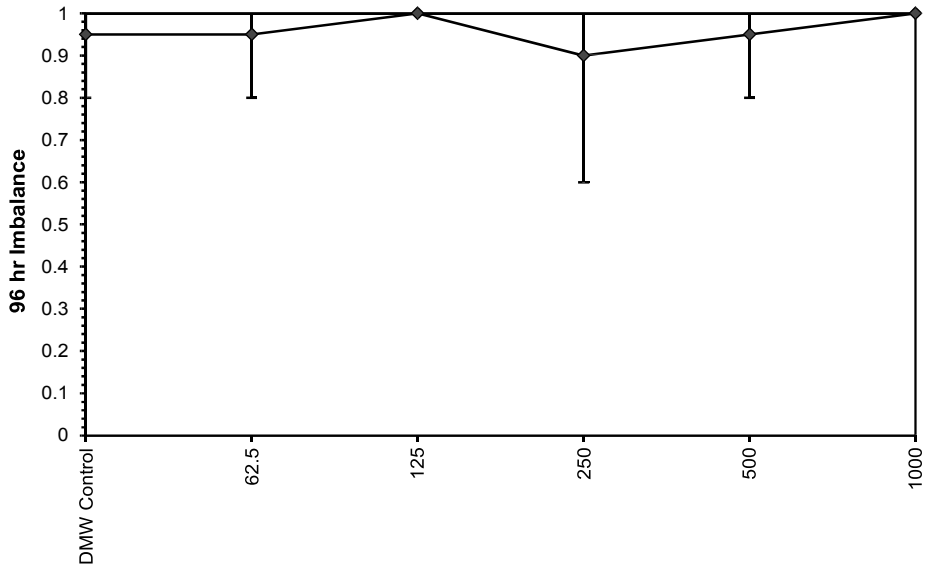
Point	mg/L	SD	95% CL(Exp)	Skew
IC05	>1000			
IC10	>1000			
IC15	>1000			
IC20	>1000			
IC25	>1000			
IC40	>1000			
IC50	>1000			



Fish Acute Toxicity Test-96 hr Imbalance

Start Date:	21/03/2014 14:00	Test ID:	PR1097/02	Sample ID:	GRT7000
End Date:	25/03/2014 14:00	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 117	Test Species:	MS-Melanotaenia splendida
Comments:					

Dose-Response Plot



Fish Acute Toxicity Test-96 hr Imbalance

Start Date:	21/03/2014 14:00	Test ID:	PR1097/02	Sample ID:	GRT7000
End Date:	25/03/2014 14:00	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 117	Test Species:	MS-Melanotaenia splendida
Comments:					

Auxiliary Data Summary

Conc-mg/L	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Un-affected	95.00	80.00	100.00	10.00	3.33	4
62.5		95.00	80.00	100.00	10.00	3.33	4
125		100.00	100.00	100.00	0.00	0.00	4
250		90.00	60.00	100.00	20.00	4.97	4
500		95.00	80.00	100.00	10.00	3.33	4
1000		100.00	100.00	100.00	0.00	0.00	4
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
62.5		8.10	8.10	8.10	0.00	0.00	1
125		8.10	8.10	8.10	0.00	0.00	1
250		8.10	8.10	8.10	0.00	0.00	1
500		8.10	8.10	8.10	0.00	0.00	1
1000		8.10	8.10	8.10	0.00	0.00	1
DMW Control	DO %	101.80	101.80	101.80	0.00	0.00	1
62.5		99.50	99.50	99.50	0.00	0.00	1
125		98.10	98.10	98.10	0.00	0.00	1
250		98.90	98.90	98.90	0.00	0.00	1
500		98.30	98.30	98.30	0.00	0.00	1
1000		98.10	98.10	98.10	0.00	0.00	1
DMW Control	Conductivity uS/cm	168.40	168.40	168.40	0.00	0.00	1
62.5		166.60	166.60	166.60	0.00	0.00	1
125		166.60	166.60	166.60	0.00	0.00	1
250		166.70	166.70	166.70	0.00	0.00	1
500		167.00	167.00	167.00	0.00	0.00	1
1000		168.90	168.90	168.90	0.00	0.00	1

Fish Acute Toxicity Test-96 hr Imbalance

Start Date:	21/03/2014 14:00	Test ID:	PR1097/03	Sample ID:	GRT8000/9000
End Date:	25/03/2014 14:00	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 117	Test Species:	MS-Melanotaenia splendida
Comments:					

Conc-mg/L	1	2	3	4
DMW Control	0.8000	1.0000	1.0000	1.0000
62.5	1.0000	0.8000	1.0000	0.8000
125	1.0000	0.8000	1.0000	1.0000
250	0.8000	1.0000	1.0000	1.0000
500	1.0000	1.0000	1.0000	0.8000
1000	1.0000	1.0000	1.0000	1.0000

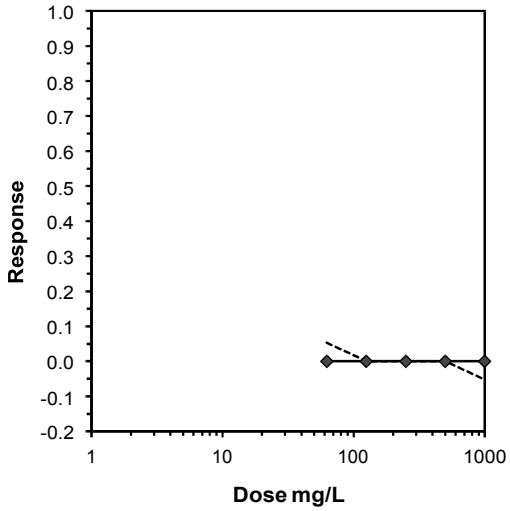
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
DMW Control	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4			0.9500	1.0000
62.5	0.9000	0.9474	1.2262	1.1071	1.3453	11.212	4	16.00	10.00	0.9500	1.0000
125	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	18.00	10.00	0.9500	1.0000
250	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	18.00	10.00	0.9500	1.0000
500	0.9500	1.0000	1.2857	1.1071	1.3453	9.261	4	18.00	10.00	0.9500	1.0000
1000	1.0000	1.0526	1.3453	1.3453	1.3453	0.000	4	20.00	10.00	0.9500	1.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.771169	0.916	-0.98097	-0.51806
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	1000	>1000		
Treatments vs DMW Control				

Log-Logit Interpolation (200 Resamples)

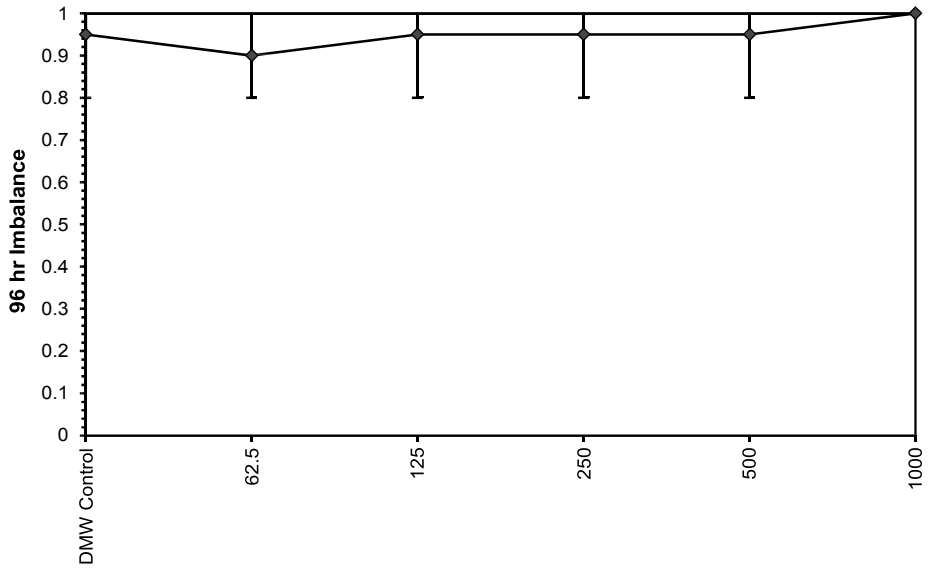
Point	mg/L	SD	95% CL(Exp)	Skew
IC05	>1000			
IC10	>1000			
IC15	>1000			
IC20	>1000			
IC25	>1000			
IC40	>1000			
IC50	>1000			



Fish Acute Toxicity Test-96 hr Imbalance

Start Date:	21/03/2014 14:00	Test ID:	PR1097/03	Sample ID:	GRT8000/9000
End Date:	25/03/2014 14:00	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 117	Test Species:	MS-Melanotaenia splendida
Comments:					

Dose-Response Plot



Fish Acute Toxicity Test-96 hr Imbalance

Start Date:	21/03/2014 14:00	Test ID:	PR1097/03	Sample ID:	GRT8000/9000
End Date:	25/03/2014 14:00	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 117	Test Species:	MS-Melanotaenia splendida
Comments:					

Auxiliary Data Summary

Conc-mg/L	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Un-affected	95.00	80.00	100.00	10.00	3.33	4
62.5		90.00	80.00	100.00	11.55	3.78	4
125		95.00	80.00	100.00	10.00	3.33	4
250		95.00	80.00	100.00	10.00	3.33	4
500		95.00	80.00	100.00	10.00	3.33	4
1000		100.00	100.00	100.00	0.00	0.00	4
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
62.5		8.10	8.10	8.10	0.00	0.00	1
125		8.10	8.10	8.10	0.00	0.00	1
250		8.10	8.10	8.10	0.00	0.00	1
500		8.10	8.10	8.10	0.00	0.00	1
1000		8.10	8.10	8.10	0.00	0.00	1
DMW Control	DO %	101.80	101.80	101.80	0.00	0.00	1
62.5		98.70	98.70	98.70	0.00	0.00	1
125		98.90	98.90	98.90	0.00	0.00	1
250		98.90	98.90	98.90	0.00	0.00	1
500		98.70	98.70	98.70	0.00	0.00	1
1000		98.40	98.40	98.40	0.00	0.00	1
DMW Control	Conductivity uS/cm	168.40	168.40	168.40	0.00	0.00	1
62.5		166.50	166.50	166.50	0.00	0.00	1
125		166.50	166.50	166.50	0.00	0.00	1
250		166.60	166.60	166.60	0.00	0.00	1
500		167.20	167.20	167.20	0.00	0.00	1
1000		168.00	168.00	168.00	0.00	0.00	1

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Statistical Printouts for the Freshwater Shrimp Tests

Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date:	25/03/2014 15:15	Test ID:	PR1097/02	Sample ID:	GRT7000
End Date:	29/03/2014 14:45	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 123	Test Species:	PSP-Paratya australiensis
Comments:					

Conc-mg/L	1	2	3	4
DMW Control	1.0000	0.8000	0.8000	1.0000
62.5	1.0000	1.0000	1.0000	1.0000
123	1.0000	0.8000	1.0000	0.6000
250	1.0000	1.0000	1.0000	1.0000
500	0.8000	1.0000	1.0000	1.0000
1000	1.0000	0.6667	0.8000	0.6000

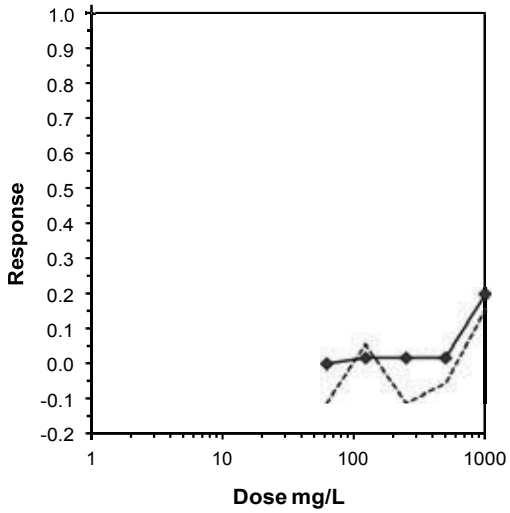
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
DMW Control	0.9000	1.0000	1.2262	1.1071	1.3453	11.212	4			0.9500	1.0000
62.5	1.0000	1.1111	1.3453	1.3453	1.3453	0.000	4	22.00	10.00	0.9500	1.0000
123	0.8500	0.9444	1.1709	0.8861	1.3453	18.840	4	17.00	10.00	0.9333	0.9825
250	1.0000	1.1111	1.3453	1.3453	1.3453	0.000	4	22.00	10.00	0.9333	0.9825
500	0.9500	1.0556	1.2857	1.1071	1.3453	9.261	4	20.00	10.00	0.9333	0.9825
1000	0.7667	0.8519	1.0735	0.8861	1.3453	18.946	4	14.00	10.00	0.7619	0.8020

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.965517	0.916	-0.13866	0.330635
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	1000	>1000		
Treatments vs DMW Control				

Log-Logit Interpolation (200 Resamples)

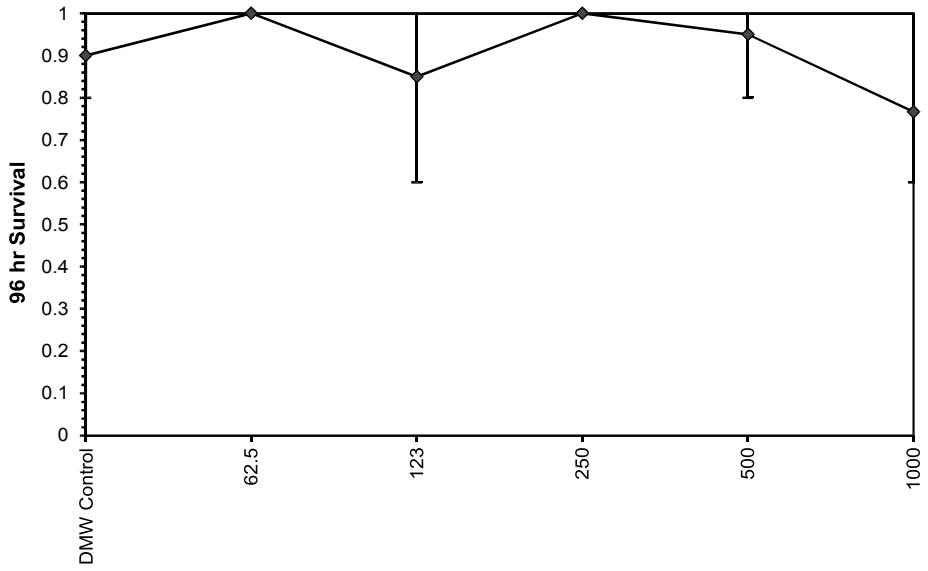
Point	mg/L	SD	95% CL(Exp)	Skew
IC05	607.28			
IC10	750.53			
IC15	880.66			
IC20	>1000			
IC25	>1000			
IC40	>1000			
IC50	>1000			



Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date:	25/03/2014 15:15	Test ID:	PR1097/02	Sample ID:	GRT7000
End Date:	29/03/2014 14:45	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 123	Test Species:	PSP-Paratya australiensis
Comments:					

Dose-Response Plot



Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date:	25/03/2014 15:15	Test ID:	PR1097/02	Sample ID:	GRT7000
End Date:	29/03/2014 14:45	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 123	Test Species:	PSP-Paratya australiensis
Comments:					

Auxiliary Data Summary

Conc-mg/L	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	90.00	80.00	100.00	11.55	3.78	4
62.5		100.00	100.00	100.00	0.00	0.00	4
123		85.00	60.00	100.00	19.15	5.15	4
250		100.00	100.00	100.00	0.00	0.00	4
500		95.00	80.00	100.00	10.00	3.33	4
1000		76.67	60.00	100.00	17.64	5.48	4
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
62.5		8.10	8.10	8.10	0.00	0.00	1
123		8.10	8.10	8.10	0.00	0.00	1
250		8.10	8.10	8.10	0.00	0.00	1
500		8.10	8.10	8.10	0.00	0.00	1
1000		8.10	8.10	8.10	0.00	0.00	1
DMW Control	Cond uS/cm	168.80	168.80	168.80	0.00	0.00	1
62.5		169.00	169.00	169.00	0.00	0.00	1
123		168.90	168.90	168.90	0.00	0.00	1
250		169.30	169.30	169.30	0.00	0.00	1
500		169.90	169.90	169.90	0.00	0.00	1
1000		171.30	171.30	171.30	0.00	0.00	1
DMW Control	DO %	101.90	101.90	101.90	0.00	0.00	1
62.5		101.90	101.90	101.90	0.00	0.00	1
123		101.70	101.70	101.70	0.00	0.00	1
250		101.70	101.70	101.70	0.00	0.00	1
500		101.90	101.90	101.90	0.00	0.00	1
1000		101.80	101.80	101.80	0.00	0.00	1

Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date:	25/03/2014 15:15	Test ID:	PR1097/03	Sample ID:	GRT8000/9000
End Date:	29/03/2014 14:45	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 123	Test Species:	PSP-Paratya australiensis
Comments:					

Conc-mg/L	1	2	3	4
DMW Control	1.0000	0.8000	0.8000	1.0000
62.5	0.8000	1.0000	1.0000	1.0000
123	1.0000	1.0000	1.0000	1.0000
250	1.0000	1.0000	0.8000	0.8000
500	0.8333	1.0000	1.0000	1.0000
1000	1.0000	1.0000	1.0000	1.0000

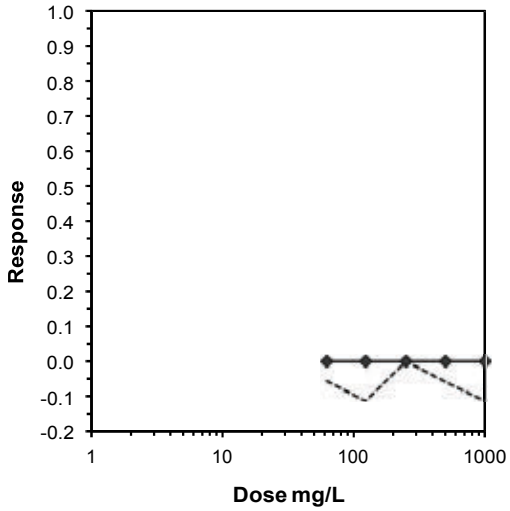
			Transform: Arcsin Square Root					Rank	1-Tailed	Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
DMW Control	0.9000	1.0000	1.2262	1.1071	1.3453	11.212	4			0.9504	1.0000
62.5	0.9500	1.0556	1.2857	1.1071	1.3453	9.261	4	20.00	10.00	0.9504	1.0000
123	1.0000	1.1111	1.3453	1.3453	1.3453	0.000	4	22.00	10.00	0.9504	1.0000
250	0.9000	1.0000	1.2262	1.1071	1.3453	11.212	4	18.00	10.00	0.9504	1.0000
500	0.9583	1.0648	1.2965	1.1503	1.3453	7.521	4	21.00	10.00	0.9504	1.0000
1000	1.0000	1.1111	1.3453	1.3453	1.3453	0.000	4	22.00	10.00	0.9504	1.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.05)	0.892434	0.916	-0.51806	-0.68089
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	1000	>1000		
Treatments vs DMW Control				

Log-Logit Interpolation (200 Resamples)

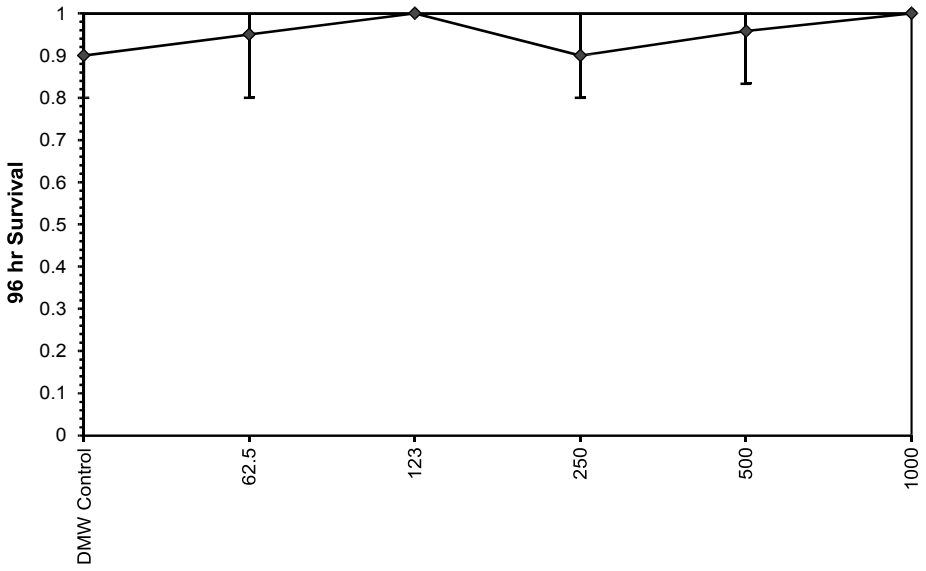
Point	mg/L	SD	95% CL(Exp)	Skew
IC05	>1000			
IC10	>1000			
IC15	>1000			
IC20	>1000			
IC25	>1000			
IC40	>1000			
IC50	>1000			



Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date:	25/03/2014 15:15	Test ID:	PR1097/03	Sample ID:	GRT8000/9000
End Date:	29/03/2014 14:45	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 123	Test Species:	PSP-Paratya australiensis
Comments:					

Dose-Response Plot



Freshwater Shrimp Acute Toxicity Test-96 hr Survival

Start Date:	25/03/2014 15:15	Test ID:	PR1097/03	Sample ID:	GRT8000/9000
End Date:	29/03/2014 14:45	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 123	Test Species:	PSP-Paratya australiensis
Comments:					

Auxiliary Data Summary

Conc-mg/L	Parameter	Mean	Min	Max	SD	CV%	N
DMW Control	% Survival	90.00	80.00	100.00	11.55	3.78	4
62.5		95.00	80.00	100.00	10.00	3.33	4
123		100.00	100.00	100.00	0.00	0.00	4
250		90.00	80.00	100.00	11.55	3.78	4
500		95.83	83.33	100.00	8.33	3.01	4
1000		100.00	100.00	100.00	0.00	0.00	4
DMW Control	pH	8.10	8.10	8.10	0.00	0.00	1
62.5		8.10	8.10	8.10	0.00	0.00	1
123		8.10	8.10	8.10	0.00	0.00	1
250		8.10	8.10	8.10	0.00	0.00	1
500		8.10	8.10	8.10	0.00	0.00	1
1000		8.10	8.10	8.10	0.00	0.00	1
DMW Control	Cond uS/cm	168.80	168.80	168.80	0.00	0.00	1
62.5		168.90	168.90	168.90	0.00	0.00	1
123		169.00	169.00	169.00	0.00	0.00	1
250		169.20	169.20	169.20	0.00	0.00	1
500		169.70	169.70	169.70	0.00	0.00	1
1000		171.00	171.00	171.00	0.00	0.00	1
DMW Control	DO %	101.90	101.90	101.90	0.00	0.00	1
62.5		102.10	102.10	102.10	0.00	0.00	1
123		102.20	102.20	102.20	0.00	0.00	1
250		102.00	102.00	102.00	0.00	0.00	1
500		102.20	102.20	102.20	0.00	0.00	1
1000		102.20	102.20	102.20	0.00	0.00	1

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Statistical Printouts for the Duckweed Growth Inhibition Tests

Duckweed Growth Inhibtion Test-Specific Growth Rate

Start Date:	28/03/2014 13:30	Test ID:	PR1097/01	Sample ID:	GRT7000
End Date:	4/04/2014 13:45	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 112	Test Species:	LD-Lemna disperma
Comments:					

Conc-mg/L	1	2	3	4
SIS Control	0.2674	0.2830	0.2878	0.3015
62.5	0.2830	0.2674	0.2560	0.2878
125	0.2971	0.2830	0.2674	0.2435
250	0.2435	0.3139	0.2674	0.2674
500	0.2560	0.2618	0.3015	0.2435
1000	0.2435	0.2971	0.2878	0.2830

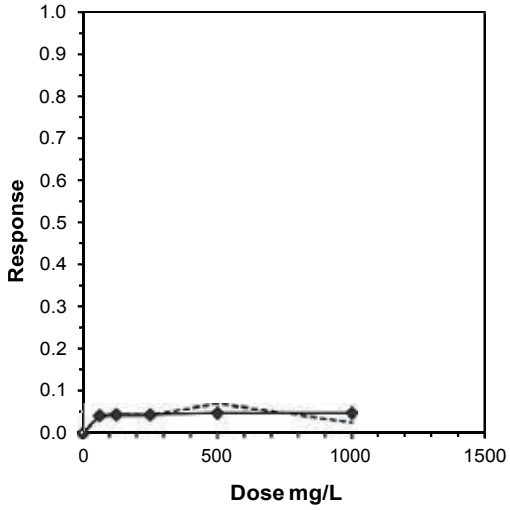
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
SIS Control	0.2849	1.0000	0.2849	0.2674	0.3015	4.933	4				0.2849	1.0000
62.5	0.2736	0.9601	0.2736	0.2560	0.2878	5.342	4	0.721	2.410	0.0380	0.2736	0.9601
125	0.2727	0.9573	0.2727	0.2435	0.2971	8.409	4	0.771	2.410	0.0380	0.2729	0.9578
250	0.2731	0.9583	0.2731	0.2435	0.3139	10.787	4	0.752	2.410	0.0380	0.2729	0.9578
500	0.2657	0.9325	0.2657	0.2435	0.3015	9.422	4	1.219	2.410	0.0380	0.2718	0.9538
1000	0.2779	0.9752	0.2779	0.2435	0.2971	8.499	4	0.448	2.410	0.0380	0.2718	0.9538

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.977628	0.916	0.192739	-0.32638
Bartlett's Test indicates equal variances (p = 0.82)	2.179199	15.08627		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1000	>1000			0.038036	0.133496	0.000163	0.000498	0.890182	5, 18
Treatments vs SIS Control										

Linear Interpolation (200 Resamples)

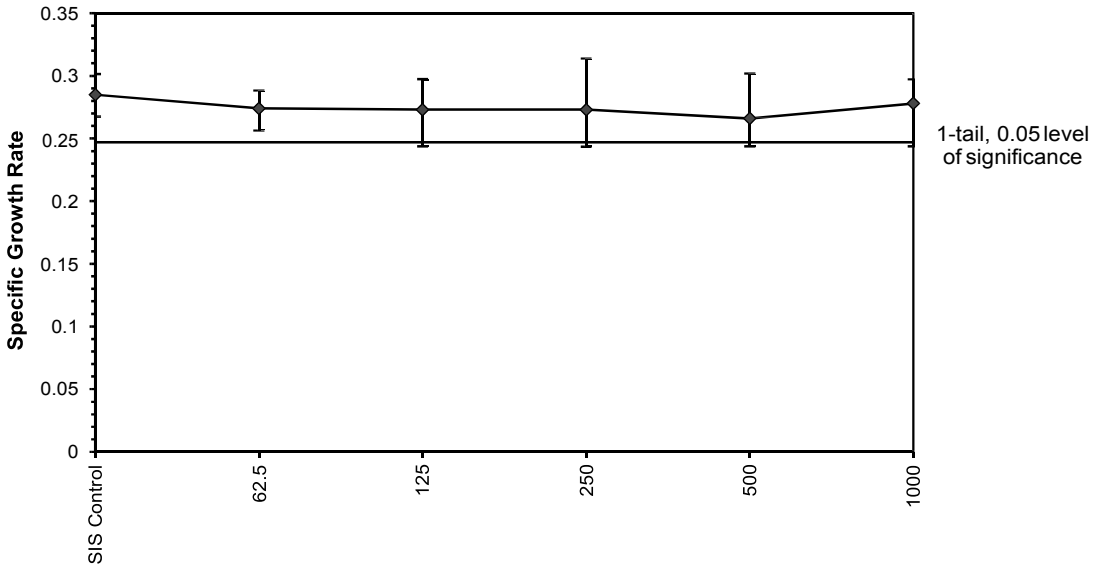
Point	mg/L	SD	95% CL(Exp)	Skew
IC05	>1000			
IC10	>1000			
IC15	>1000			
IC20	>1000			
IC25	>1000			
IC40	>1000			
IC50	>1000			



Duckweed Growth Inhibtion Test-Specific Growth Rate

Start Date:	28/03/2014 13:30	Test ID:	PR1097/01	Sample ID:	GRT7000
End Date:	4/04/2014 13:45	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 112	Test Species:	LD-Lemna disperma
Comments:					

Dose-Response Plot



Duckweed Growth Inhibtion Test-Specific Growth Rate

Start Date:	28/03/2014 13:30	Test ID:	PR1097/01	Sample ID:	GRT7000
End Date:	4/04/2014 13:45	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 112	Test Species:	LD-Lemna disperma
Comments:					

Auxiliary Data Summary

Conc-mg/L	Parameter	Mean	Min	Max	SD	CV%	N
SIS Control	Specific Growth Rate	0.28	0.27	0.30	0.01	41.61	4
62.5		0.27	0.26	0.29	0.01	44.19	4
125		0.27	0.24	0.30	0.02	55.53	4
250		0.27	0.24	0.31	0.03	62.85	4
500		0.27	0.24	0.30	0.03	59.55	4
1000		0.28	0.24	0.30	0.02	55.31	4
SIS Control	pH	6.50	6.50	6.50	0.00	0.00	1
62.5		6.50	6.50	6.50	0.00	0.00	1
125		6.50	6.50	6.50	0.00	0.00	1
250		6.50	6.50	6.50	0.00	0.00	1
500		6.50	6.50	6.50	0.00	0.00	1
1000		6.50	6.50	6.50	0.00	0.00	1
SIS Control	Cond uS/cm	283.00	283.00	283.00	0.00	0.00	1
62.5		284.00	284.00	284.00	0.00	0.00	1
125		284.00	284.00	284.00	0.00	0.00	1
250		284.00	284.00	284.00	0.00	0.00	1
500		285.00	285.00	285.00	0.00	0.00	1
1000		285.00	285.00	285.00	0.00	0.00	1

Duckweed Growth Inhibtion Test-Specific Growth Rate

Start Date:	28/03/2014 13:30	Test ID:	PR1097/02	Sample ID:	GRT8000/9000
End Date:	4/04/2014 13:45	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 112	Test Species:	LD-Lemna disperma
Comments:					

Conc-mg/L	1	2	3	4
SIS Control	0.2674	0.2830	0.2878	0.3015
62.5	0.2830	0.2971	0.2674	0.2618
125	0.2435	0.2674	0.2780	0.2560
250	0.3015	0.2674	0.2435	0.2226
500	0.3139	0.2226	0.2674	0.2728
1000	0.2780	0.2878	0.2971	0.2299

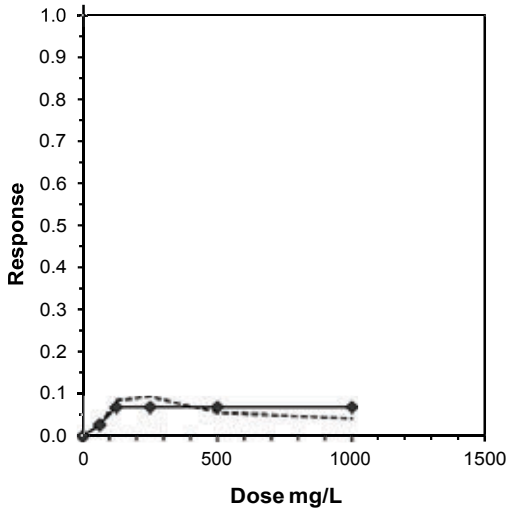
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
SIS Control	0.2849	1.0000	0.2849	0.2674	0.3015	4.933	4				0.2849	1.0000
62.5	0.2773	0.9733	0.2773	0.2618	0.2971	5.745	4	0.411	2.410	0.0446	0.2773	0.9733
125	0.2612	0.9168	0.2612	0.2435	0.2780	5.677	4	1.281	2.410	0.0446	0.2656	0.9321
250	0.2587	0.9081	0.2587	0.2226	0.3015	13.083	4	1.415	2.410	0.0446	0.2656	0.9321
500	0.2692	0.9447	0.2692	0.2226	0.3139	13.877	4	0.852	2.410	0.0446	0.2656	0.9321
1000	0.2732	0.9589	0.2732	0.2299	0.2971	10.940	4	0.634	2.410	0.0446	0.2656	0.9321

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.966906	0.916	-0.1777	0.158451
Bartlett's Test indicates equal variances (p = 0.42)	4.978806	15.08627		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs SIS Control	1000	>1000			0.044578	0.156455	0.00039	0.000684	0.722145	5, 18

Linear Interpolation (200 Resamples)

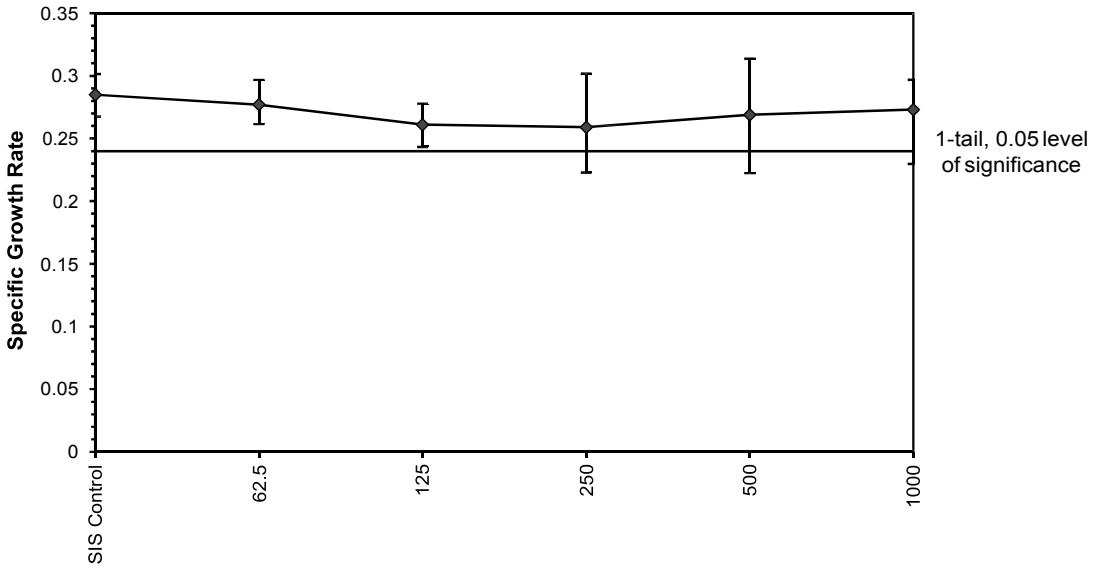
Point	mg/L	SD	95% CL(Exp)	Skew
IC05	97.857			
IC10	>1000			
IC15	>1000			
IC20	>1000			
IC25	>1000			
IC40	>1000			
IC50	>1000			



Duckweed Growth Inhibtion Test-Specific Growth Rate

Start Date:	28/03/2014 13:30	Test ID:	PR1097/02	Sample ID:	GRT8000/9000
End Date:	4/04/2014 13:45	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 112	Test Species:	LD-Lemna disperma
Comments:					

Dose-Response Plot



Duckweed Growth Inhibtion Test-Specific Growth Rate

Start Date:	28/03/2014 13:30	Test ID:	PR1097/02	Sample ID:	GRT8000/9000
End Date:	4/04/2014 13:45	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 112	Test Species:	LD-Lemna disperma
Comments:					

		Auxiliary Data Summary					
Conc-mg/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
SIS Control	Specific Growth Rate	0.28	0.27	0.30	0.01	41.61	4
62.5		0.28	0.26	0.30	0.02	45.51	4
125		0.26	0.24	0.28	0.01	46.62	4
250		0.26	0.22	0.30	0.03	71.11	4
500		0.27	0.22	0.31	0.04	71.80	4
1000		0.27	0.23	0.30	0.03	63.28	4
SIS Control	pH	6.50	6.50	6.50	0.00	0.00	1
62.5		6.40	6.40	6.40	0.00	0.00	1
125		6.40	6.40	6.40	0.00	0.00	1
250		6.40	6.40	6.40	0.00	0.00	1
500		6.40	6.40	6.40	0.00	0.00	1
1000		6.40	6.40	6.40	0.00	0.00	1
SIS Control	Cond uS/cm	283.00	283.00	283.00	0.00	0.00	1
62.5		284.00	284.00	284.00	0.00	0.00	1
125		284.00	284.00	284.00	0.00	0.00	1
250		284.00	284.00	284.00	0.00	0.00	1
500		284.00	284.00	284.00	0.00	0.00	1
1000		285.00	285.00	285.00	0.00	0.00	1

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SERVICES AUSTRALASIA

Statistical Printouts for the *Selenastrum* Growth Inhibition Tests

Microalgal Cell Yield-Cell Yield

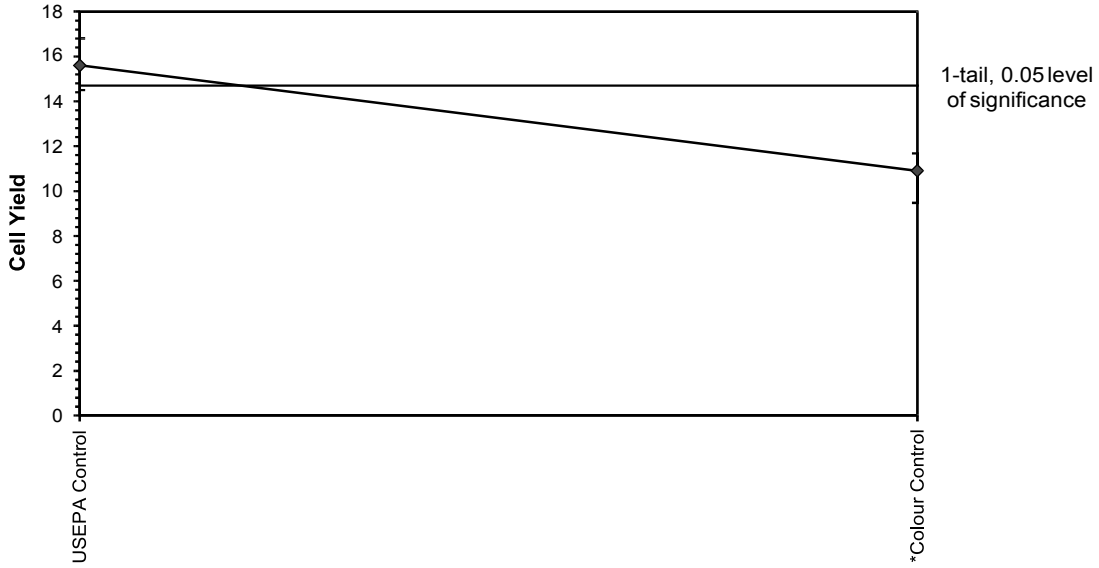
Start Date:	21/03/2014 15:30	Test ID:	PR1097/02b	Sample ID:	Controls	
End Date:	24/03/2014 14:30	Lab ID:	6520	Sample Type:	AQ-Aqueous	
Sample Date:		Protocol:	ESA 103	Test Species:	SC-Selenastrum	capricornutum
Comments:						

Conc-	1	2	3	4	5	6	7	8
USEPA Control	16.516	15.616	15.516	14.516	15.316	15.116	15.516	16.816
Colour Control	11.116	9.516	11.416	11.716				

			Transform: Untransformed					1-Tailed		
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
USEPA Control	15.616	1.0000	15.616	14.516	16.816	4.731	8			
*Colour Control	10.941	0.7006	10.941	9.516	11.716	8.967	4	9.321	1.812	0.909

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.971514		0.859		-0.30783	-0.30369
F-Test indicates equal variances (p = 0.48)	1.763743		10.88245			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates significant differences Treatments vs USEPA Control	0.909002	0.058211	58.28167	0.67075	3.0E-06	1, 10

Dose-Response Plot



Microalgal Cell Yield-Cell Yield

Start Date:	21/03/2014 15:30	Test ID:	PR1097/02b	Sample ID:	Controls End
Date:	24/03/2014 14:30	Lab ID:	6520	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 103	Test Species:	SC-Selenastrum capricornutum
Comments:					

Auxiliary Data Summary

Conc-	Parameter	Mean	Min	Max	SD	CV%	N
USEPA Control	Cell Yield	15.62	14.52	16.82	0.74	5.50	8
Colour Control		10.94	9.52	11.72	0.98	9.05	4
USEPA Control	pH	7.40	7.40	7.40	0.00	0.00	1
Colour Control		7.40	7.40	7.40	0.00	0.00	1
USEPA Control	Conductivity uS/cm	94.10	94.10	94.10	0.00	0.00	1
Colour Control		94.10	94.10	94.10	0.00	0.00	1

Microalgal Cell Yield-Cell Yield

Start Date:	21/03/2014 15:30	Test ID:	PR1097/02	Sample ID:	GRT7000	
End Date:	24/03/2014 14:30	Lab ID:	6520	Sample Type:	CP-Chemical product	
Sample Date:		Protocol:	ESA 103	Test Species:	SC-Selenastrum capricornutum	
Comments:						

Conc-mg/L	1	2	3	4	5	6	7	8
USEPA Control	16.516	15.616	15.516	14.516	15.316	15.116	15.516	16.816
Colour Control	11.116	9.516	11.416	11.716				
62.5	14.316	10.716	15.116	15.416				
125	12.816	15.516	14.516	15.616				
250	18.916	12.316	13.816	16.316				
500	14.316	16.016	19.516	12.916				
1000	14.616	11.316	10.716	12.616				

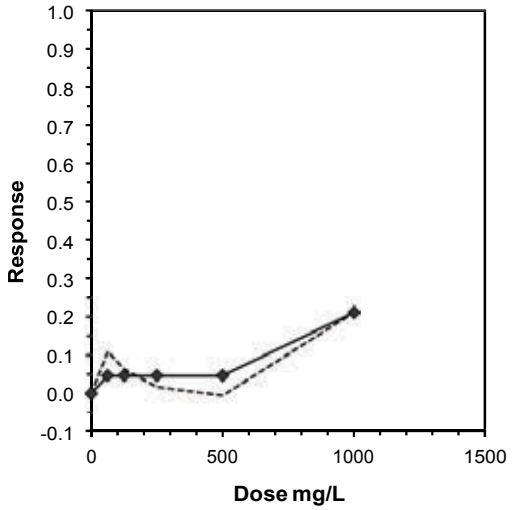
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
USEPA Control	15.616	1.4273	15.616	14.516	16.816	4.731	8	*			15.616	1.0000
Colour Control	10.941	1.0000	10.941	9.516	11.716	8.967	4					
62.5	13.891	1.2696	13.891	10.716	15.416	15.600	4	1.464	2.508	2.955	14.884	0.9532
125	14.616	1.3359	14.616	12.816	15.616	8.886	4	0.849	2.508	2.955	14.884	0.9532
250	15.341	1.4022	15.341	12.316	18.916	18.896	4	0.233	2.508	2.955	14.884	0.9532
500	15.691	1.4342	15.691	12.916	19.516	18.149	4	-0.064	2.508	2.955	14.884	0.9532
*1000	12.316	1.1257	12.316	10.716	14.616	14.017	4	2.801	2.508	2.955	12.316	0.7887

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.969486	0.924	0.189119	0.152315
Bartlett's Test indicates equal variances (p = 0.08)	9.740289	15.08627		
The control means are significantly different (p = 3.01E-06)	9.321496	2.228139		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	500	1000	707.1068		2.955382	0.189258	7.528857	3.701932	0.113252	5, 22
Treatments vs USEPA Control										

Linear Interpolation (200 Resamples)

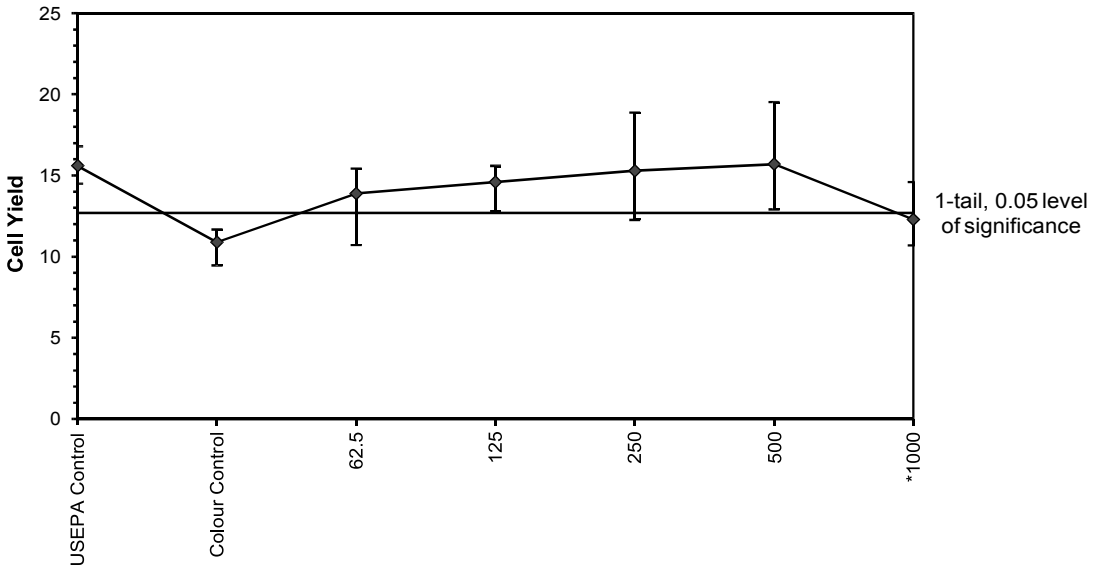
Point	mg/L	SD	95% CL(Exp)		Skew
IC05	509.64	256.40	0.00	748.52	-0.1205
IC10	661.62				
IC15	813.59				
IC20	965.57				
IC25	>1000				
IC40	>1000				
IC50	>1000				



Microalgal Cell Yield-Cell Yield

Start Date:	21/03/2014 15:30	Test ID:	PR1097/02	Sample ID:	GRT7000
End Date:	24/03/2014 14:30	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 103	Test Species:	SC-Selenastrum capricornutum
Comments:					

Dose-Response Plot



Microalgal Cell Yield-Cell Yield

Start Date:	21/03/2014 15:30	Test ID:	PR1097/02	Sample ID:	GRT7000
End Date:	24/03/2014 14:30	Lab ID:	6520	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 103	Test Species:	SC-Selenastrum capricornutum
Comments:					

		Auxiliary Data Summary					
Conc-mg/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
USEPA Control	Cell Yield	15.62	14.52	16.82	0.74	5.50	8
Colour Control		10.94	9.52	11.72	0.98	9.05	4
62.5		13.89	10.72	15.42	2.17	10.60	4
125		14.62	12.82	15.62	1.30	7.80	4
250		15.34	12.32	18.92	2.90	11.10	4
500		15.69	12.92	19.52	2.85	10.75	4
1000		12.32	10.72	14.62	1.73	10.67	4
USEPA Control	pH	7.40	7.40	7.40	0.00	0.00	1
Colour Control		7.40	7.40	7.40	0.00	0.00	1
62.5		7.40	7.40	7.40	0.00	0.00	1
125		7.30	7.30	7.30	0.00	0.00	1
250		7.30	7.30	7.30	0.00	0.00	1
500		7.30	7.30	7.30	0.00	0.00	1
1000		7.50	7.50	7.50	0.00	0.00	1
USEPA Control	Conductivity uS/cm	94.10	94.10	94.10	0.00	0.00	1
Colour Control		94.10	94.10	94.10	0.00	0.00	1
62.5		94.00	94.00	94.00	0.00	0.00	1
125		93.90	93.90	93.90	0.00	0.00	1
250		94.80	94.80	94.80	0.00	0.00	1
500		96.70	96.70	96.70	0.00	0.00	1
1000		98.70	98.70	98.70	0.00	0.00	1

Microalgal Cell Yield-Cell Yield

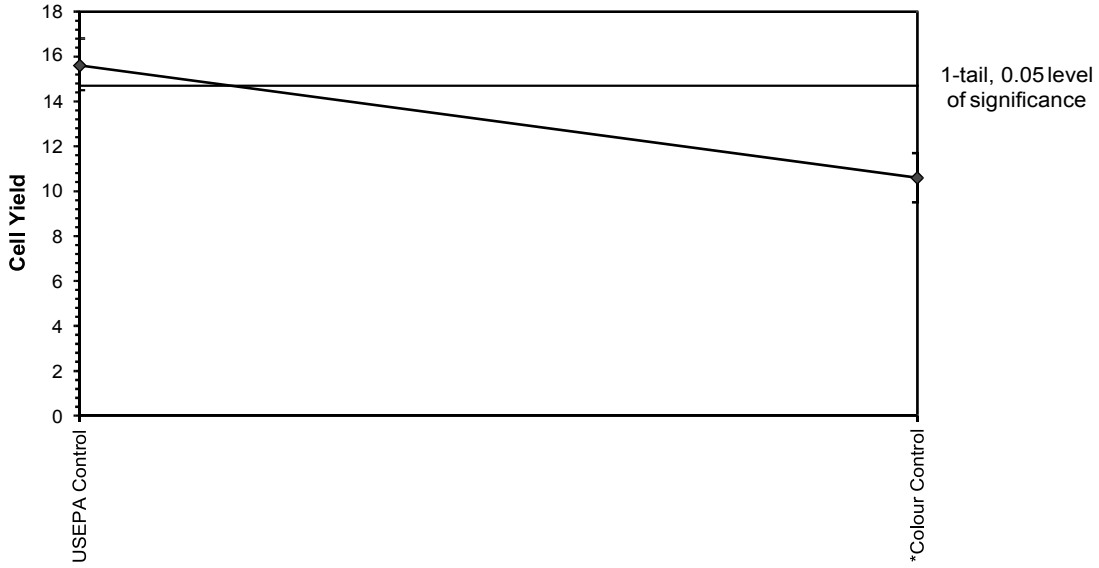
Start Date:	21/03/2014 15:30	Test ID:	PR1097/03b	Sample ID:	Controls	
End Date:	24/03/2014 14:30	Lab ID:	6521	Sample Type:	AQ-Aqueous	
Sample Date:		Protocol:	ESA 103	Test Species:	SC-Selenastrum	capricornutum
Comments:						

Conc-	1	2	3	4	5	6	7	8
USEPA Control	16.516	15.616	15.516	14.516	15.316	15.116	15.516	16.816
Colour Control	10.520	11.720	9.520	10.720				

			Transform: Untransformed					1-Tailed		
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
USEPA Control	15.616	1.0000	15.616	14.516	16.816	4.731	8			
*Colour Control	10.620	0.6801	10.620	9.520	11.720	8.492	4	10.311	1.812	0.878

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.913996		0.859		0.246992	-0.53359
F-Test indicates equal variances (p = 0.60)	1.490401		10.88245			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates significant differences Treatments vs USEPA Control	0.878156	0.056236	66.54938	0.626	1.2E-06	1, 10

Dose-Response Plot



Microalgal Cell Yield-Cell Yield

Start Date:	21/03/2014 15:30	Test ID:	PR1097/03b	Sample ID:	Controls End
Date:	24/03/2014 14:30	Lab ID:	6521	Sample Type:	AQ-Aqueous
Sample Date:		Protocol:	ESA 103	Test Species:	SC-Selenastrum capricornutum
Comments:					

Auxiliary Data Summary

Conc-	Parameter	Mean	Min	Max	SD	CV%	N
USEPA Control	Cell Yield	15.62	14.52	16.82	0.74	5.50	8
Colour Control		10.62	9.52	11.72	0.90	8.94	4
USEPA Control	pH	7.40	7.40	7.40	0.00	0.00	1
Colour Control		7.40	7.40	7.40	0.00	0.00	1
USEPA Control	Conductivity uS/cm	94.10	94.10	94.10	0.00	0.00	1
Colour Control		94.10	94.10	94.10	0.00	0.00	1

Microalgal Cell Yield-Cell Yield

Start Date:	21/03/2014 15:30	Test ID:	PR1097/03	Sample ID:	GRT8000/9000	
End Date:	24/03/2014 14:30	Lab ID:	6521	Sample Type:	CP-Chemical product	
Sample Date:		Protocol:	ESA 103	Test Species:	SC-Selenastrum capricornutum	
Comments:						

Conc-mg/L	1	2	3	4	5	6	7	8
USEPA Control	16.516	15.616	15.516	14.516	15.316	15.116	15.516	16.816
62.5	15.016	13.116	13.716	13.816				
125	17.216	16.016	12.616	14.416				
250	14.816	15.016	13.816	14.916				
500	13.716	11.316	11.016	16.416				
1000	10.116	10.416	11.016	14.216				

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
USEPA Control	15.616	1.0000	15.616	14.516	16.816	4.731	8				15.616	1.0000
62.5	13.916	0.8911	13.916	13.116	15.016	5.719	4	1.876	2.508	2.273	14.541	0.9312
125	15.066	0.9648	15.066	12.616	17.216	13.248	4	0.607	2.508	2.273	14.541	0.9312
250	14.641	0.9376	14.641	13.816	15.016	3.798	4	1.076	2.508	2.273	14.541	0.9312
*500	13.116	0.8399	13.116	11.016	16.416	19.137	4	2.759	2.508	2.273	13.116	0.8399
*1000	11.441	0.7326	11.441	10.116	14.216	16.498	4	4.607	2.508	2.273	11.441	0.7326

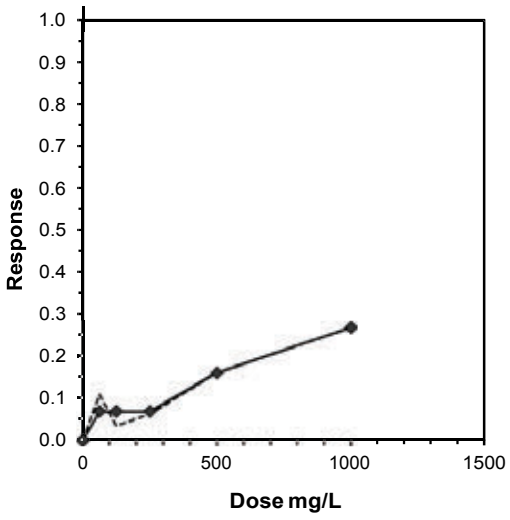
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.05)	0.964213	0.924	0.60335	0.662417
Bartlett's Test indicates equal variances (p = 0.04)	11.54276	15.08627		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test	250	500	353.5534		2.273233	0.145574	11.05786	2.190227	0.003128	5, 22
Treatments vs USEPA Control										

Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL(Exp)		Skew
IC05*	45.39	106.00	15.83	494.04	2.0454
IC10	335.36	145.87	0.00	842.83	0.1957
IC15	472.34				
IC20	686.01				
IC25	919.07				
IC40	>1000				
IC50	>1000				

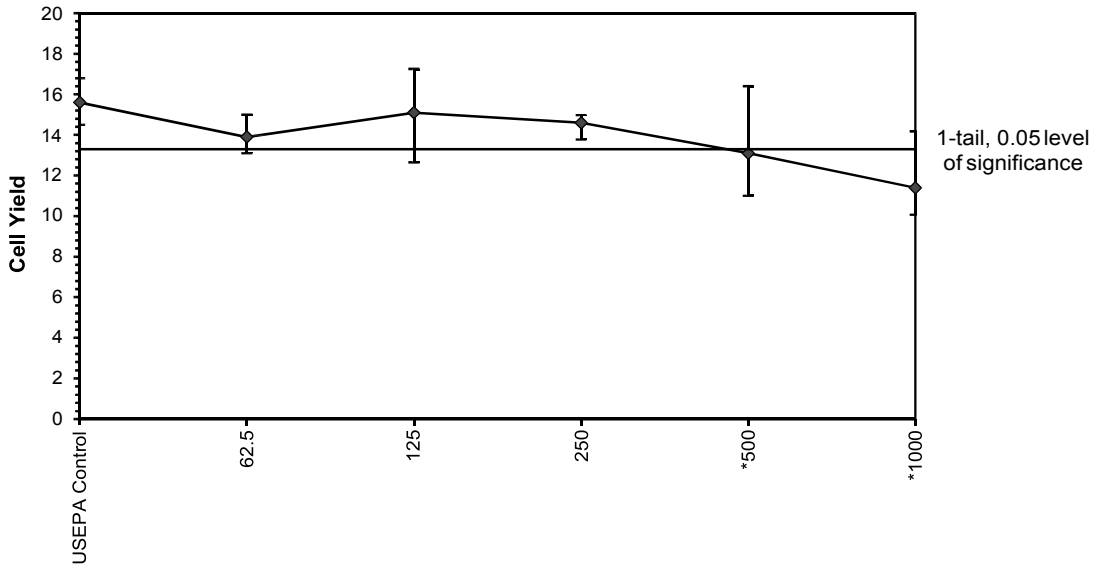
* indicates IC estimate less than the lowest concentration



Microalgal Cell Yield-Cell Yield

Start Date:	21/03/2014 15:30	Test ID:	PR1097/03	Sample ID:	GRT8000/9000
End Date:	24/03/2014 14:30	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 103	Test Species:	SC-Selenastrum capricornutum
Comments:					

Dose-Response Plot



Microalgal Cell Yield-Cell Yield

Start Date:	21/03/2014 15:30	Test ID:	PR1097/03	Sample ID:	GRT8000/9000
End Date:	24/03/2014 14:30	Lab ID:	6521	Sample Type:	CP-Chemical product
Sample Date:		Protocol:	ESA 103	Test Species:	SC-Selenastrum capricornutum
Comments:					

		Auxiliary Data Summary					
Conc-mg/L	**Parameter**	**Mean**	**Min**	**Max**	**SD**	**CV%**	**N**
USEPA Control	Cell Yield	15.62	14.52	16.82	0.74	5.50	8
62.5		13.92	13.12	15.02	0.80	6.41	4
125		15.07	12.62	17.22	2.00	9.38	4
250		14.64	13.82	15.02	0.56	5.09	4
500		13.12	11.02	16.42	2.51	12.08	4
1000		11.44	10.12	14.22	1.89	12.01	4
USEPA Control	pH	7.40	7.40	7.40	0.00	0.00	1
62.5		7.30	7.30	7.30	0.00	0.00	1
125		7.30	7.30	7.30	0.00	0.00	1
250		7.20	7.20	7.20	0.00	0.00	1
500		7.30	7.30	7.30	0.00	0.00	1
1000		7.30	7.30	7.30	0.00	0.00	1
USEPA Control	Conductivity uS/cm	94.10	94.10	94.10	0.00	0.00	1
62.5		95.40	95.40	95.40	0.00	0.00	1
125		93.90	93.90	93.90	0.00	0.00	1
250		95.00	95.00	95.00	0.00	0.00	1
500		96.00	96.00	96.00	0.00	0.00	1
1000		98.80	98.80	98.80	0.00	0.00	1

Annex B

ALS Analytical Reports

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1407380**	Page	: 1 of 10
Amendment	: **2**		
Client	: **ENVIRO RESOURCES MANAGEMENT**	Laboratory	: Environmental Division Sydney
Contact	: MS OLIVIA PATTERSON	Contact	: Barbara Hanna
Address	: GROUND FLOOR 33 SAUNDERS STREET, PYRMONT NSW 2009 LOCKED BAG 24 BROADWAY NSW, AUSTRALIA 2007	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: olivia.patterson@erm.com	E-mail	: Barbara.Hanna@alsglobal.com
Telephone	: +61 02 8584 8888	Telephone	: +61 2 8784 8555
Facsimile	: +61 02 8584 8800	Facsimile	: +61 2 8784 8555
Project Order	: 0222833	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
numberC-O-C	: ----		
number	: ----	Date Samples Received	: 04-APR-2014
Sampler	: ----	Issue Date	: 06-MAY-2014
Site	: ----		
		No. of samples received	2
Quote number	: EN/009/13	No. of samples analysed	2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
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General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

I **EP075: 'Sum of PAH' is the sum of the USEPA 16 priority PAHs**

I **This report has been amended and re-released to allow the reporting of additional analytical data.**

I **This report has been amended as a result of misinterpretation of sample identification numbers (IDs). All analysis results are as per the previous report**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SOIL STABILISED WITH GRT7000	SOIL STABILISED WITH GRT8000/9000	----	----	----
				Client sampling date / time	01-APR-2014 15:00	01-APR-2014 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1407380-001	ES1407380-002	----	----	----
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		**0.003**	**0.002**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L		**0.006**	**0.004**	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.004**	**0.003**	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.009**	**0.021**	----	----	----
Lead	7439-92-1	0.001	mg/L		**0.009**	**0.004**	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.079**	**0.104**	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**10**	**9**	----	----	----
EP026ST: Chemical Oxygen Demand (Sealed Tube)									
Chemical Oxygen Demand	----	5	mg/L		**61**	**37**	----	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	**3**	----	----	----
EP070: Total Petroleum Hydrocarbons - Speciation									
Aromatic C10-C14	----	50	µg/L		<50	<50	----	----	----
Aromatic C15-C28	----	100	µg/L		<100	<100	----	----	----
Aromatic C29-C36	----	50	µg/L		<50	<50	----	----	----
Aliphatic C10-C14	----	50	µg/L		<50	<50	----	----	----
Aliphatic C15-C28	----	100	µg/L		<100	<100	----	----	----
Aliphatic C29-C36	----	50	µg/L		<50	<50	----	----	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	<1.0	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	----	----	----
3- &4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Unit	Client sample ID	SOIL STABILISED WITH GRT7000	SOIL STABILISED WITH GRT8000/9000	----	----	----
				Client sampling date / time	01-APR-2014 15:00	01-APR-2014 15:00	----	----	----
					ES1407380-001	ES1407380-002	----	----	----
EP075(SIM)A: Phenolic Compounds - Continued									
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(b)fluoranthene	205-99-2	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	----	----	----
EP075A: Phenolic Compounds									
Phenol	108-95-2	2	µg/L		<2	<2	----	----	----
2-Chlorophenol	95-57-8	2	µg/L		<2	<2	----	----	----
2-Methylphenol	95-48-7	2	µg/L		<2	<2	----	----	----
3- & 4-Methylphenol	1319-77-3	4	µg/L		<4	<4	----	----	----
2-Nitrophenol	88-75-5	2	µg/L		<2	<2	----	----	----
2.4-Dimethylphenol	105-67-9	2	µg/L		<2	<2	----	----	----
2.4-Dichlorophenol	120-83-2	2	µg/L		<2	<2	----	----	----
2.6-Dichlorophenol	87-65-0	2	µg/L		<2	<2	----	----	----
4-Chloro-3-methylphenol	59-50-7	2	µg/L		<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	SOIL STABILISED WITH GRT7000	SOIL STABILISED WITH GRT8000/9000	----	----	----
			Client sampling date / time	01-APR-2014 15:00	01-APR-2014 15:00	----	----	----
Compound	CAS Number	LOR	Unit	ES1407380-001	ES1407380-002	----	----	----
EP075A: Phenolic Compounds - Continued								
2.4.6-Trichlorophenol	88-06-2	2	µg/L	<2	<2	----	----	----
2.4.5-Trichlorophenol	95-95-4	2	µg/L	<2	<2	----	----	----
Pentachlorophenol	87-86-5	4	µg/L	<4	<4	----	----	----
EP075B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	2	µg/L	<2	<2	----	----	----
2-Methylnaphthalene	91-57-6	2	µg/L	<2	<2	----	----	----
2-Chloronaphthalene	91-58-7	2	µg/L	<2	<2	----	----	----
Acenaphthylene	208-96-8	2	µg/L	<2	<2	----	----	----
Acenaphthene	83-32-9	2	µg/L	<2	<2	----	----	----
Fluorene	86-73-7	2	µg/L	<2	<2	----	----	----
Phenanthrene	85-01-8	2	µg/L	<2	<2	----	----	----
Anthracene	120-12-7	2	µg/L	<2	<2	----	----	----
Fluoranthene	206-44-0	2	µg/L	<2	<2	----	----	----
Pyrene	129-00-0	2	µg/L	<2	<2	----	----	----
N-2-Fluorenyl Acetamide	53-96-3	2	µg/L	<2	<2	----	----	----
Benz(a)anthracene	56-55-3	2	µg/L	<2	<2	----	----	----
Chrysene	218-01-9	2	µg/L	<2	<2	----	----	----
Benzo(b) & Benzo(k)fluoranthene	205-99-2 207-08-9	4	µg/L	<4	<4	----	----	----
7.12-Dimethylbenz(a)anthracene	57-97-6	2	µg/L	<2	<2	----	----	----
Benzo(a)pyrene	50-32-8	2	µg/L	<2	<2	----	----	----
3-Methylcholanthrene	56-49-5	2	µg/L	<2	<2	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	2	µg/L	<2	<2	----	----	----
Dibenz(a.h)anthracene	53-70-3	2	µg/L	<2	<2	----	----	----
Benzo(g.h.i)perylene	191-24-2	2	µg/L	<2	<2	----	----	----
Sum of PAHs	----	2	µg/L	<2	<2	----	----	----
Benzo(a)pyrene TEQ (zero)	----	2	µg/L	<2	<2	----	----	----
EP075C: Phthalate Esters								
Dimethyl phthalate	131-11-3	2	µg/L	<2	<2	----	----	----
Diethyl phthalate	84-66-2	2	µg/L	<2	<2	----	----	----
Di-n-butyl phthalate	84-74-2	2	µg/L	2	<2	----	----	----
Butyl benzyl phthalate	85-68-7	2	µg/L	<2	<2	----	----	----
bis(2-ethylhexyl) phthalate	117-81-7	5	µg/L	14	8	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SOIL STABILISED WITH GRT7000	SOIL STABILISED WITH GRT8000/9000	----	----	----
				Client sampling date / time	01-APR-2014 15:00	01-APR-2014 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1407380-001	ES1407380-002	----	----	----
EP075C: Phthalate Esters - Continued									
Di-n-octylphthalate	117-84-0	2	µg/L		<2	<2	----	----	----
EP075D: Nitrosamines									
N-Nitrosomethylethylamine	10595-95-6	2	µg/L		<2	<2	----	----	----
N-Nitrosodiethylamine	55-18-5	2	µg/L		<2	<2	----	----	----
N-Nitrosopyrrolidine	930-55-2	4	µg/L		<4	<4	----	----	----
N-Nitrosomorpholine	59-89-2	2	µg/L		<2	<2	----	----	----
N-Nitrosodi-n-propylamine	621-64-7	2	µg/L		<2	<2	----	----	----
N-Nitrosopiperidine	100-75-4	2	µg/L		<2	<2	----	----	----
N-Nitrosodibutylamine	924-16-3	2	µg/L		<2	<2	----	----	----
N-Nitrosodiphenyl & Diphenylamine	86-30-6 122-39-4	4	µg/L		<4	<4	----	----	----
Methapyrilene	91-80-5	2	µg/L		<2	<2	----	----	----
EP075E: Nitroaromatics and Ketones									
2-Picoline	109-06-8	2	µg/L		<2	<2	----	----	----
Acetophenone	98-86-2	2	µg/L		<2	<2	----	----	----
Nitrobenzene	98-95-3	2	µg/L		<2	<2	----	----	----
Isophorone	78-59-1	2	µg/L		<2	<2	----	----	----
2.6-Dinitrotoluene	606-20-2	4	µg/L		<4	<4	----	----	----
2.4-Dinitrotoluene	121-14-2	4	µg/L		<4	<4	----	----	----
1-Naphthylamine	134-32-7	2	µg/L		<2	<2	----	----	----
4-Nitroquinoline-N-oxide	56-57-5	2	µg/L		<2	<2	----	----	----
5-Nitro-o-toluidine	99-55-8	2	µg/L		<2	<2	----	----	----
Azobenzene	103-33-3	2	µg/L		<2	<2	----	----	----
1.3.5-Trinitrobenzene	99-35-4	2	µg/L		<2	<2	----	----	----
Phenacetin	62-44-2	2	µg/L		<2	<2	----	----	----
4-Aminobiphenyl	92-67-1	2	µg/L		<2	<2	----	----	----
Pentachloronitrobenzene	82-68-8	2	µg/L		<2	<2	----	----	----
Pronamide	23950-58-5	2	µg/L		<2	<2	----	----	----
Dimethylaminoazobenzene	60-11-7	2	µg/L		<2	<2	----	----	----
Chlorobenzilate	510-15-6	2	µg/L		<2	<2	----	----	----
EP075F: Haloethers									
Bis(2-chloroethyl) ether	111-44-4	2	µg/L		<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SOIL STABILISED WITH GRT7000	SOIL STABILISED WITH GRT8000/9000	----	----	----
				Client sampling date / time	01-APR-2014 15:00	01-APR-2014 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1407380-001	ES1407380-002	----	----	----
EP075F: Haloethers - Continued									
Bis(2-chloroethoxy) methane	111-91-1	2	µg/L		<2	<2	----	----	----
4-Chlorophenyl phenyl ether	7005-72-3	2	µg/L		<2	<2	----	----	----
4-Bromophenyl phenyl ether	101-55-3	2	µg/L		<2	<2	----	----	----
EP075G: Chlorinated Hydrocarbons									
1.3-Dichlorobenzene	541-73-1	2	µg/L		<2	<2	----	----	----
1.4-Dichlorobenzene	106-46-7	2	µg/L		<2	<2	----	----	----
1.2-Dichlorobenzene	95-50-1	2	µg/L		<2	<2	----	----	----
Hexachloroethane	67-72-1	2	µg/L		<2	<2	----	----	----
1.2.4-Trichlorobenzene	120-82-1	2	µg/L		<2	<2	----	----	----
Hexachloropropylene	1888-71-7	2	µg/L		<2	<2	----	----	----
Hexachlorobutadiene	87-68-3	2	µg/L		<2	<2	----	----	----
Hexachlorocyclopentadiene	77-47-4	10	µg/L		<10	<10	----	----	----
Pentachlorobenzene	608-93-5	2	µg/L		<2	<2	----	----	----
Hexachlorobenzene (HCB)	118-74-1	4	µg/L		<4	<4	----	----	----
EP075H: Anilines and Benzidines									
Aniline	62-53-3	2	µg/L		<2	<2	----	----	----
4-Chloroaniline	106-47-8	2	µg/L		<2	<2	----	----	----
2-Nitroaniline	88-74-4	4	µg/L		<4	<4	----	----	----
3-Nitroaniline	99-09-2	4	µg/L		<4	<4	----	----	----
Dibenzofuran	132-64-9	2	µg/L		<2	<2	----	----	----
4-Nitroaniline	100-01-6	2	µg/L		<2	<2	----	----	----
Carbazole	86-74-8	2	µg/L		<2	<2	----	----	----
3.3`-Dichlorobenzidine	91-94-1	2	µg/L		<2	<2	----	----	----
EP075I: Organochlorine Pesticides									
alpha-BHC	319-84-6	2	µg/L		<2	<2	----	----	----
beta-BHC	319-85-7	2	µg/L		<2	<2	----	----	----
gamma-BHC	58-89-9	2	µg/L		<2	<2	----	----	----
delta-BHC	319-86-8	2	µg/L		<2	<2	----	----	----
Heptachlor	76-44-8	2	µg/L		<2	<2	----	----	----
Aldrin	309-00-2	2	µg/L		<2	<2	----	----	----
Heptachlor epoxide	1024-57-3	2	µg/L		<2	<2	----	----	----
alpha-Endosulfan	959-98-8	2	µg/L		<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SOIL STABILISED WITH GRT7000	SOIL STABILISED WITH GRT8000/9000	----	----	----
				Client sampling date / time	01-APR-2014 15:00	01-APR-2014 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1407380-001	ES1407380-002	----	----	----
EP075I: Organochlorine Pesticides - Continued									
4.4`-DDE	72-55-9	2	µg/L		<2	<2	----	----	----
Dieldrin	60-57-1	2	µg/L		<2	<2	----	----	----
Endrin	72-20-8	2	µg/L		<2	<2	----	----	----
beta-Endosulfan	33213-65-9	2	µg/L		<2	<2	----	----	----
4.4`-DDD	72-54-8	2	µg/L		<2	<2	----	----	----
Endosulfan sulfate	1031-07-8	2	µg/L		<2	<2	----	----	----
4.4`-DDT	50-29-3	4	µg/L		<4	<4	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	4	µg/L		<4	<4	----	----	----
^ Sum of DDD + DDE + DDT	----	4	µg/L		<4	<4	----	----	----
EP075J: Organophosphorus Pesticides									
Dichlorvos	62-73-7	2	µg/L		<2	<2	----	----	----
Dimethoate	60-51-5	2	µg/L		<2	<2	----	----	----
Diazinon	333-41-5	2	µg/L		<2	<2	----	----	----
Chlorpyrifos-methyl	5598-13-0	2	µg/L		<2	<2	----	----	----
Malathion	121-75-5	2	µg/L		<2	<2	----	----	----
Fenthion	55-38-9	2	µg/L		<2	<2	----	----	----
Chlorpyrifos	2921-88-2	2	µg/L		<2	<2	----	----	----
Pirimphos-ethyl	23505-41-1	2	µg/L		<2	<2	----	----	----
Chlorfenvinphos	470-90-6	2	µg/L		<2	<2	----	----	----
Prothiofos	34643-46-4	2	µg/L		<2	<2	----	----	----
Ethion	563-12-2	2	µg/L		<2	<2	----	----	----
EP070S:TPH Surrogates - Speciation									
2-Fluorobiphenyl	321-60-8	0.1	%		107	97.6	----	----	----
2-Bromonaphthalene	580-13-2	0.1	%		93.1	85.6	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		20.7	10.0	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		59.6	34.9	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		77.3	54.0	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		66.7	50.6	----	----	----
Anthracene-d10	1719-06-8	0.1	%		69.4	53.4	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		61.5	47.8	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SOIL STABILISED WITH GRT7000	SOIL STABILISED WITH GRT8000/9000	----	----	----
				Client sampling date / time	01-APR-2014 15:00	01-APR-2014 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1407380-001	ES1407380-002	----	----	----
EP075S: Acid Extractable Surrogates									
2-Fluorophenol	367-12-4	0.1	%		53.7	31.2	----	----	----
Phenol-d6	13127-88-3	0.1	%		23.4	22.4	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		66.5	40.8	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		72.3	47.4	----	----	----
EP075T: Base/Neutral Extractable Surrogates									
Nitrobenzene-D5	4165-60-0	0.1	%		71.6	55.0	----	----	----
1.2-Dichlorobenzene-D4	2199-69-1	0.1	%		66.9	52.0	----	----	----
2-Fluorobiphenyl	321-60-8	0.1	%		73.5	55.2	----	----	----
Anthracene-d10	1719-06-8	0.1	%		78.0	60.4	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		75.5	58.4	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP070S:TPH Surrogates - Speciation			
2-Fluorobiphenyl	321-60-8	80	112
2-Bromonaphthalene	580-13-2	75	111
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP075S: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	10.0	116.6
Phenol-d6	13127-88-3	10.0	69.0
2-Chlorophenol-D4	93951-73-6	20.9	129.7
2.4.6-Tribromophenol	118-79-6	10.0	150.7
EP075T: Base/Neutral Extractable Surrogates			
Nitrobenzene-D5	4165-60-0	29.4	141.7
1.2-Dichlorobenzene-D4	2199-69-1	23.6	120.7
2-Fluorobiphenyl	321-60-8	27.2	134.9
Anthracene-d10	1719-06-8	26.6	113
4-Terphenyl-d14	1718-51-0	21.4	123

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1409145**	Page	: 1 of 6
Client	: **ENVIRO RESOURCES MANAGEMENT**	Laboratory	: Environmental Division Sydney
Contact	: MS OLIVIA PATTERSON	Contact	: Barbara Hanna
Address	: GROUND FLOOR 33 SAUNDERS STREET, PYRMONT NSW 2009 LOCKED BAG 24 BROADWAY NSW, AUSTRALIA 2007	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: olivia.patterson@erm.com	E-mail	: Barbara.Hanna@alsglobal.com
Telephone	: +61 02 8584 8888	Telephone	: +61 2 8784 8555
Facsimile	: +61 02 8584 8800	Facsimile	: +61 2 8784 8555
Project Order	: 0222833	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
numberC-O-C	: ----		
number	: ----	Date Samples Received	: 24-APR-2014
Sampler	: ----	Issue Date	: 29-APR-2014
Site	: ----		
		No. of samples received	2
Quote number	: EN/009/13	No. of samples analysed	2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SOIL STABILISED GRT-700	SOIL STABILISED GRT8001900	----	----	----
				Client sampling date / time	23-APR-2014 15:00	23-APR-2014 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1409145-001	ES1409145-002	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.65	7.18	----	----	----
EP074A: Monocyclic Aromatic Hydrocarbons									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
Styrene	100-42-5	5	µg/L		<5	<5	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
Isopropylbenzene	98-82-8	5	µg/L		<5	<5	----	----	----
n-Propylbenzene	103-65-1	5	µg/L		<5	<5	----	----	----
1.3.5-Trimethylbenzene	108-67-8	5	µg/L		<5	<5	----	----	----
sec-Butylbenzene	135-98-8	5	µg/L		<5	<5	----	----	----
1.2.4-Trimethylbenzene	95-63-6	5	µg/L		<5	<5	----	----	----
tert-Butylbenzene	98-06-6	5	µg/L		<5	<5	----	----	----
p-Isopropyltoluene	99-87-6	5	µg/L		<5	<5	----	----	----
n-Butylbenzene	104-51-8	5	µg/L		<5	<5	----	----	----
EP074B: Oxygenated Compounds									
Vinyl Acetate	108-05-4	50	µg/L		<50	<50	----	----	----
2-Butanone (MEK)	78-93-3	50	µg/L		<50	<50	----	----	----
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L		<50	<50	----	----	----
2-Hexanone (MBK)	591-78-6	50	µg/L		<50	<50	----	----	----
EP074C: Sulfonated Compounds									
Carbon disulfide	75-15-0	5	µg/L		<5	<5	----	----	----
EP074D: Fumigants									
2.2-Dichloropropane	594-20-7	5	µg/L		<5	<5	----	----	----
1.2-Dichloropropane	78-87-5	5	µg/L		<5	<5	----	----	----
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L		<5	<5	----	----	----
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L		<5	<5	----	----	----
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L		<5	<5	----	----	----
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	50	µg/L		<50	<50	----	----	----
Chloromethane	74-87-3	50	µg/L		<50	<50	----	----	----
Vinyl chloride	75-01-4	50	µg/L		<50	<50	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	SOIL STABILISED GRT-700	SOIL STABILISED GRT8001900	----	----	----
				Client sampling date / time	23-APR-2014 15:00	23-APR-2014 15:00	----	----	----
					ES1409145-001	ES1409145-002	----	----	----
EP074E: Halogenated Aliphatic Compounds - Continued									
Bromomethane	74-83-9	50	µg/L		<50	<50	----	----	----
Chloroethane	75-00-3	50	µg/L		<50	<50	----	----	----
Trichlorofluoromethane	75-69-4	50	µg/L		<50	<50	----	----	----
1.1-Dichloroethene	75-35-4	5	µg/L		<5	<5	----	----	----
Iodomethane	74-88-4	5	µg/L		<5	<5	----	----	----
trans-1.2-Dichloroethene	156-60-5	5	µg/L		<5	<5	----	----	----
1.1-Dichloroethane	75-34-3	5	µg/L		<5	<5	----	----	----
cis-1.2-Dichloroethene	156-59-2	5	µg/L		<5	<5	----	----	----
1.1.1-Trichloroethane	71-55-6	5	µg/L		<5	<5	----	----	----
1.1-Dichloropropylene	563-58-6	5	µg/L		<5	<5	----	----	----
Carbon Tetrachloride	56-23-5	5	µg/L		<5	<5	----	----	----
1.2-Dichloroethane	107-06-2	5	µg/L		<5	<5	----	----	----
Trichloroethene	79-01-6	5	µg/L		<5	<5	----	----	----
Dibromomethane	74-95-3	5	µg/L		<5	<5	----	----	----
1.1.2-Trichloroethane	79-00-5	5	µg/L		<5	<5	----	----	----
1.3-Dichloropropane	142-28-9	5	µg/L		<5	<5	----	----	----
Tetrachloroethene	127-18-4	5	µg/L		<5	<5	----	----	----
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L		<5	<5	----	----	----
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L		<5	<5	----	----	----
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L		<5	<5	----	----	----
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L		<5	<5	----	----	----
1.2.3-Trichloropropane	96-18-4	5	µg/L		<5	<5	----	----	----
Pentachloroethane	76-01-7	5	µg/L		<5	<5	----	----	----
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L		<5	<5	----	----	----
Hexachlorobutadiene	87-68-3	5	µg/L		<5	<5	----	----	----
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	5	µg/L		<5	<5	----	----	----
Bromobenzene	108-86-1	5	µg/L		<5	<5	----	----	----
2-Chlorotoluene	95-49-8	5	µg/L		<5	<5	----	----	----
4-Chlorotoluene	106-43-4	5	µg/L		<5	<5	----	----	----
1.3-Dichlorobenzene	541-73-1	5	µg/L		<5	<5	----	----	----
1.4-Dichlorobenzene	106-46-7	5	µg/L		<5	<5	----	----	----
1.2-Dichlorobenzene	95-50-1	5	µg/L		<5	<5	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SOIL STABILISED GRT-700	SOIL STABILISED GRT8001900	----	----	----
				Client sampling date / time	23-APR-2014 15:00	23-APR-2014 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1409145-001	ES1409145-002	----	----	----
EP074F: Halogenated Aromatic Compounds - Continued									
1.2.4-Trichlorobenzene	120-82-1	5	µg/L		<5	<5	----	----	----
1.2.3-Trichlorobenzene	87-61-6	5	µg/L		<5	<5	----	----	----
EP074G: Trihalomethanes									
Chloroform	67-66-3	5	µg/L		<5	<5	----	----	----
Bromodichloromethane	75-27-4	5	µg/L		<5	<5	----	----	----
Dibromochloromethane	124-48-1	5	µg/L		<5	<5	----	----	----
Bromoform	75-25-2	5	µg/L		<5	<5	----	----	----
EP074H: Naphthalene									
Naphthalene	91-20-3	7	µg/L		<7	<7	----	----	----
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		108	113	----	----	----
Toluene-D8	2037-26-5	0.1	%		126	121	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		116	118	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	78.3	133.2
Toluene-D8	2037-26-5	79.1	128.9
4-Bromofluorobenzene	460-00-4	80.8	123.7

Annex C

MSDSs

MSDS sheets are available on request

Annex D

Livestock Toxicity Profiles

Emulsifier

Chemical Description and Use

Chemical Name	Emulsifier
Synonyms	-
CAS	Proprietary
Molecular Formula	Comprises a mixture of hydrocarbons, typically carbon chains between 7 – 16 carbon atoms per molecule.
Product Name	Proprietary
Product description	Part of the products GRT8000 and GRT9000
Product use	The emulsifier is added in order to ensure the mixing of the bitumen and the polymer. It is found in both GRT8000 and GRT9000. It is a major component of aviation fuel and is also used as a solvent, degreaser and in paints, insecticides, domestic fuels. [WHO]

Fate in the Environment

Air	If this emulsifier, un emulsified, is released to air it has a high vapour pressure and the compound will exist as vapour in the atmosphere. This vapour phase is degraded easily with a half life of between 0.27- 2.2days. [4]
Water	If this emulsifier, un-emulsified, is released to water, volatilisation is expected to be an important fate process, however slower volatilisation can be expected from groundwater or from water with a high sediment loading, where adsorbtion processes are taking place. [4]
Soil	If this emulsifier, un-emulsified, is released to soil some of the constituent compounds will be will display low mobility and some will be considered immobile in soil based upon high Koc values for the compounds with longer carbon chains. However the volatilisation from moist soil is also an important migration pathway. [4]

Background exposure

Air	Occupational exposure to this emulsifier may occur through inhalation and dermal contact with this compound at workplaces. Monitoring data indicates that the general population may be exposed via inhalation of ambient urban air as it is used frequently as a solvent, a degreaser and in domestic fuel. [6]
Water	Exposure to this emulsifier is considered unlikely to be via the ingestion of drinking water. This emulsifier is not found naturally and is not considered a normal constituent in surface or groundwater.[6] [7]
Soil	Exposure to this emulsifier is considered unlikely to be via ingestion of soils or dermal contact with soils. [6]
Food	Exposure to this emulsifier is considered unlikely to be via ingestion of food. [6]
Product Use	Monitoring data indicates that the general population may be exposed via dermal contact with the emulsifier during its use as a product (heating, fuel, in paints, insecticides). [6] [7]

Cattle Toxicity Data

No cattle toxicity data for the polymer is available from the USEPA (2007) Ecotox Database [11].

Mammalian Toxicity Data Related to Component Compounds

The table below presents a summary of ecotoxicity data for the constituent parts of the emulsifier:

Constituent Compounds[1]	Surrogate Compound[2]	NOEL Used [3]	Study Type	End point
Alkyl monoaromatics	Low PAHs	50	Chronic rat study	LOAEL
Branched Alkanes	n-alkanes	50	Reproductive Rat study	NOAEL
Diaromatics	Low PAHs	50	Chronic rat study	LOAEL
Monoaromatics	Low PAHs	50	Chronic rat study	LOAEL
n-alkanes	n-alkanes	50	Reproductive Rat study	NOAEL
Naphthalenes	Low PAHs	50	Chronic rat study	LOAEL
Low PAHs	Low PAHs	50	Chronic rat study	LOAEL
High PAHs	Low PAHs	10	Chronic mice study	LOAEL

[1]Based on the breakdown presented in Ref. [1]

[2] A surrogate compound was chosen to represent these groups of compounds based on the most conservative chemical in each constituent group, eg. Most toxic or most mobile.

[3] Based on values provided in Tables 1 and 2 in Ref. [2] for aliphatic or aromatic Oral RfDs for the relevant carbon chain range.

Physical Properties

	Value and Units	Reference
Molecular Weight	Range of weights.	4
Vapour Pressure	0.48 mm Hg	4/7
Density	742 kg/m^3	8
Solubility	<1.0 x 10-3 g TOC/L	8
Air Diffusion Coefficient	-	-
Water Diffusion Coefficient	-	-
Henry's Law Coefficient	7.3x10^{-12} to 6.0x10^{-11} cu cm/molecule-sec	4
Koc	2.21 – 5.63	8
Log Kow	3.17 - >6.5	8
Odour Threshold	Characteristic odour	7
Dermal Absorption	-	-

Reference List

1. Total Petroleum Hydrocarbon Criteria Working Group Series, 1997, *Volume 2, Composition of Petroleum Mixtures,* Amherst Scientific Publishers
2. Total Petroleum Hydrocarbon Criteria Working Group Series, 1997, *Volume 4, Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH)*, Amherst Scientific Publishers.
3. GRT8000 and 9000, Material Safety Data Sheet, Global Road Technology Australia Pty Ltd, Level 15 Corporate Centre One, 2 Corporate Court Bundall QLD 4217. August 2012.
4. Hazardous Substances Data Bank (HSDB), http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~DF0fiQ:1 accessed 20th July 2012.
5. United States Environmental Protection Agency (US EPA) (2007) ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. http:/www.epa.gov/ecotox/, accessed 20th July 2012.
6. National Institute for Occupational Safety and Health (NIOSH) (2007) NIOSH Pocket Guide to Chemical Hazards DHHS (NIOSH) Publication No. 2005-149, National Institute for Occupational Safety and Health, Centres for Disease Control and Prevention, Department of Health and Human Services (DHHS), http://www.cdc.gov/niosh/, accessed 20th July 2012.
7. Health Protection Agency, *HPA Compendium of Chemical Hazards, Kerosene* CHAPD HQ, 2006.
8. National Industrial Chemicals Notification and Assessment Scheme – NICNAS, *Full Public Report, GTL Kerosine*, October 2008.

Bitumen

Chemical Description and Use

Chemical Name	Bitumen
Synonyms	Asphalt
CAS	8052-42-4
Molecular Formula	Mixture of highly condensed chemicals, including polycyclic aromatic hydrocarbons (PAHs) and crystalline silica [1,5]. Asphalt is commonly comprised of a colloid of asphaltenes in the dispersed phase and maltenes in the continuous phase. Most natural bitumen contains sulphur and metals.
Product Name	GRT9000 and GRT8000 – both contain bitumen
Product description	Dark brown to black, cement-like semisolid or solid or viscous liquid produced by the non-destructive distillation of crude oil during petroleum refining [1].
Product use	The GRT 8000 and 9000 products contain 45-50% bitumen. The GRT preparation is sprayed in a mixture with water for sealing purposes and dust control of road, haul and hardstand pavements [2].

Fate in the Environment

Air	It is considered unlikely that bitumen or its components will volatilise to air in significant concentrations, unless heated. However there is a potential for particulate matter to be generated following heavy road usage.
Water	There is potential that PAH compounds may leach from bitumen and associated dusts and subsequently into run-off water, where it may be transported to groundwater or surface water.
Soil	PAHs that have leached from bitumen may adsorb to soils depending on the organic carbon content and clay content of the soils. Particulate matter generated during heavy road usage may also enter soil.

Background exposure

Air	Inhalation of particulate matter generated following heavy road usage can be an exposure route. Occupational exposure to heated bitumen during industrial use may occur through inhalation of bitumen fumes comprising of a mixture of PAHs, which are generated at elevated temperatures at workplaces [1].
Water	Owing to their low solubility and high affinity with particulate matter, PAHs are not usually found in water in notable concentrations [1]. PAHs are generally not been reported in Australian drinking water supplies [3]. PAHs are considered unlikely to be leached from bitumen and ingested via the consumption of drinking water.
Soil	Background data on bitumen concentrations in soil is limited. The compounds expected to leach from bitumen such as PAHs are not commonly found in soils unless there is a significant source such as petroleum leak or gas works.

Food	No data is available on levels of asphalt components in foodstuffs. PAHs may bioaccumulate in the environment, but, due to their low water solubilities and high molecular masses, the bioavailability of bitumen components is expected to be generally limited [1]. Analyses of components of runoff from asphalt pavement in fish and invertebrates from streams in USA reported PAH concentrations below the detection limit [1].

Cattle Toxicity Data

No cattle toxicity data for the polymer is available from the USEPA (2007) Ecotox Database [6].

Mammalian Toxicity Data Related to Component Compounds

The table below presents a summary of ecotoxicity data for the constituent parts of bitumen:

Constituent Compounds[1]	Surrogate Compound[2]	NOEL Used [3] mg/kg bw/day	Study Type	End point
Asphaltenes	Aliphatic $C_{>16}$ - $C_{21,}$ $C_{>21}$ – C_{35}	2	Nephrotoxicity Rat study	NOAEL
Hard resins	Aliphatic $C_{>16}$ - $C_{21,}$ $C_{>21}$ – C_{35}	2	Nephrotoxicity Rat study	NOAEL
Soft resins	$C_{>16}$ - $C_{21,}$ $C_{>21}$ – C_{35}	2	Nephrotoxicity Rat study	NOAEL
Oils	$C_{>16}$ - $C_{21,}$ $C_{>21}$ – C_{35}	2	Nephrotoxicity Rat study	NOAEL
Waxes	$C_{>16}$ - $C_{21,}$ $C_{>21}$ – C_{35}	2	Nephrotoxicity Rat study	NOAEL

[1]Based on the breakdown presented in Ref. [9]

[2]Based on the most conservative chemical in each constituent group, eg. Most toxic or most mobile.

[3] Based on values provided in Tables 1 and 2 in Ref. [8] for aliphatic or aromatic Oral RfDs for the relevant carbon chain range.

Bitumen also comprises vanadium and nickel, which have been studied for effects on beef cattle:

Metals:	Toxicity Ref. Value mg/kg/day	Reference
Vanadium	4.2	10
Nickel	1.7	11

Physical Properties

Physical properties for asphalt are presented in the table below.

	Value and Units	Reference
Molecular Weight	Ranges from 500 to 15,000	1
Vapour Pressure	$<1.0 \times 10^{-10}$ to 1.6×10^{-5} mm Hg	7
Relative Density (water = 1)	1.0 – 1.18	1
Solubility	Insoluble in water at 20°C ($<1.0 \times 10^{-5}$ mg/L); partially soluble in aliphatic organic solvents; and soluble in carbon disulfide, chloroform, ether and acetone.	4, 7
Air Diffusion Coefficient	-	-
Water Diffusion Coefficient	-	-
Henry's Law Coefficient	-	-
Koc	-	-
Log Kow	> 6	1
Odour Threshold	Tarry odour	4
Dermal Absorption	-	-

Reference List

1. World Health Organisation (WHO) (2004) Concise International Chemical Assessment Document 59. *Asphalt (Bitumen).*
2. *GRT8000 and 9000*, Material Safety Data Sheet, Global Road Technology Australia Pty Ltd, Level 15 Corporate Centre One, 2 Corporate Court Bundall QLD 4217 AUSTRALIA. August 2012
3. National Health and Medical Research Council (NHMRC), Natural Resource Management Ministerial Council (NRMMC) (2011) *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy*, National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra
4. Hazardous Substances Data Bank (HSDB) Toxicology Data Network, http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~DF0fiQ:1 accessed 24th April 2014.
5. Material Safety Data Sheet for Asphalt (unhardened and hardened asphalt), http://www.rinkerpipe.com/Toolbox/MSDS/ASPHALT.pdf accessed 24th April 2014.
6. Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines, National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT.
7. United States Environmental Protection Agency (US EPA)(2011) Hazard Characterization Document. *Screening-Level Hazard Characterization – Asphalt Category*. http://www.epa.gov/chemrtk/hpvis/hazchar/Category_Asphalts_March_2011.pdf , accessed 30th July 2012.

8. Total Petroleum Hydrocarbon Criteria Working Group Series, 1997, *Volume 4, Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH)*, Amherst Scientific Publishers.
9. World Health Organisation (WHO) (2004) Concise International Chemical Assessment Document 59, *Asphalt (Bitumen)*
10. USEPA (2005).*Ecological Soil Screening Levels for Vanadium Interim Final OSWER Directive 9285.7-75*
11. USEPA (2007). *Ecological Soil Screening Levels for Nickel Interim Final OSWER Directive 9285.7-76*

Styrene Acrylic hybrid polymer

Chemical Description and Use

Chemical Name	Styrene Acrylic hybrid polymer
Synonyms	-
CAS	100 -42 -5(styrene) 141-32-2(acrylic)
Molecular Formula	-
Product Name	Part of GRT9000
Product description	GRT 9000 is an opaque brown liquid with a faint odour [1].
Product use	The GRT 9000 product contains 15-30% of the acrylate polymer. The GRT preparation is sprayed as a mixture with water for sealing purposes and dust control of road, haul and hardstand pavements [1].

Fate in the Environment

Air	Limited information is available on the fate of this specific copolymer in the environment. However, acrylate polymers in general are stable in the environment and are not expected to break down by hydrolysis, undergo thermal degradation, photodegradation or depolymerisation. Any incineration of acrylate polymers is expected to produce water and oxides of carbon and nitrogen [2]
Water	Low water solubility is expected for the cross-linked copolymer, reducing the potential for leaching [2].
Soil	Acrylate polymers quickly become immobile upon association with soil layer [2]. Any styrene that is released into the soil may be broken down by bacteria or other microorganisms [3].

Background exposure

Air	It is considered unlikely that the polymer is generally present in air in significant concentrations, given its high molecular weight and generally low level of volatility. Any styrene monomer that evaporates into the atmosphere is quickly broken down, usually within 1-2 days, and is therefore not likely to be persistent in the environment [3].
Water	This polymer is unlikely to be present in water at significant background concentrations, as it has limited reactivity with the water phase. Due to the low water solubility of acrylate polymers, the potential for the leaching of these chemicals into waters are low [2]. Styrene has not been found in Australian drinking water sources [4].
Soil	The matrix structure of acrylate polymers limits the hydrolysis or biodegradation of the polymer, resulting in its potential persistence in the environment [2].

Cattle Toxicity Data

No cattle toxicity data for the polymer is available from the USEPA (2007) Ecotox Database [6].

Mammalian Toxicity Data related to the Polymer Component Compounds

Species	Exposure Duration (mean)	Test Location	Observed Response Mean	Endpoint	Effect
Styrene – Ref. [6]					
Rat	78 weeks	Laboratory	2000 mg/kg-d	LOAEL	*Mortality*
Dog	561 Days	Laboratory	200 mg/kg-d	NOAEL	*Heinz Body Formation*
Polymer acid – Ref. [6]					
Rat		Laboratory	78 mg/kg-d	NOAEL	*Effects on feeding behaviour*

Physical Properties

	Value and Units	Reference
Molecular Weight	1,090,000 (average for acrylic polymers)	2
Vapour Pressure	Negligible	5
Density	-	-
Solubility	Negligible	5
Air Diffusion Coefficient	-	-
Water Diffusion Coefficient	-	-
Henry's Law Coefficient	-	-
Koc	-	-
Log Kow	-	-
Odour Threshold	-	-
Dermal Absorption	-	-

Reference List

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3. Agency for Toxic Substances and Disease Registry (ATSDR) Public Health Statement: Styrene. June 2012. Available at: http://www.atsdr.cdc.gov/ToxProfiles/tp53-c1-b.pdf.

4. National Health and Medical Research Council (NHMRC), Natural Resource Management Ministerial Council (NRMMC) (2011) *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy*, National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra
5. National Industrial Chemicals Notification and Assessment Scheme (NICNAS) Full Public Report: Polymer of 2-propenoic acid, butyl ester, diethenylbenzene and etheylbenzene. 23 August 1991. Available at: http://www.nicnas.gov.au/publications/car/new/na/nafullr/na0000fr/na13fr.pdf.
6. United States Environmental Protection Agency (US EPA) (2007) ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. http:/www.epa.gov/ecotox/, accessed 1ST August 2012.

Annex E

Livestock Calculations

Calculations			aliphatics												
Parameter	Acronym	Units	Oil	Styrene	Polymer Acid	Aliphatics (n-alkanes)	LowPAHs	HighPAHs	Ashaltenes	Hard resins	Soft resins	Oils	Waxes	Vanadium	Nickel
Test Species			Mice	Dog	Rat	Rat	Rat	Mice	Rat	Rat	Rat	Rat	Rat	Based on USEPA Ecological Soil Screening Levels for Vanadium Interim Final OSWER Directive 9285.7-75	Based on USEPA Ecological Soil Screening Levels for Nickel Interim Final OSWER Directive 9285.7-76
Body Weight Test Species	$BW_{Test\ Species}$	kg	0.035	10	0.35	0.35	0.35	0.035	0.35	0.35	0.35	0.35	0.35		
Livestock			Beef Cattle	Beef Cattle	Beef Cattle	Beef Cattle	Beef Cattle	Beef Cattle	Beef Cattle	Beef Cattle	Beef Cattle	Beef Cattle	Beef Cattle	Beef Cattle	Beef Cattle
Body Weight for Target Livestock	BW_{AOC}	kg	454	454	454	454	454	454	454	454	454	454	454	454	454
Scaling Factor	SF	unitless	0.09	0.39	0.17	0.17	0.17	0.09	0.17	0.17	0.17	0.17	0.17		
Effects Level	NOAEL	mg/kg-day	50	200	78	50	50	10	50	100	100	100	100		
NOAEL or LOAEL		--	NOAEL	NOAEL	NOAEL	NOAEL	LOAEL	LOAEL	NOAEL	NOAEL	NOAEL	NOAEL	NOAEL		
Duration of Tox Test		--	Chronic	Chronic	Chronic	Reproductive	Chronic	Chronic	Reproductive	Reproductive	Reproductive	Reproductive	Reproductive		
Dossing Schedule Adjustment (e.g. converting from 5 days per week doses to daily doses).		--	0.71	1.00	1	1	1	1	1	1	1	1	1		
Uncertainty Factor	UF	--	1	1	1	1	10	10	1	1	1	1	1		
Toxicity Reference Value	TRV	mg/kg-day	3.33	77.05	13.0	8.33	0.833	0.094	8.33	16.7	16.7	16.66	16.7	4.2	1.7
Acceptable Hazard Quotient	HQ	unitless	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Ingestion Rate	IR_{soil}	kg	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13
Soil Ingestion Risk Based Screening Level	*soil* RBSL	mg/kg-day	**709.0**	**16,422.6**	**2,770.3**	**1,775.8**	**177.6**	**20**	**1,775.8**	**3,552**	**3,552**	**3,552**	**3,552**	**886.7**	**362.3**
Soil Ingestion Risk Based Screening Level with AUF		mg/kg-day	**70,901.9**	**1,642,261.4**	**277,028.1**	**177,582.1**	**17,758.2**	**1,997.2**	**177,582.1**	**355,164.3**	**355,164.3**	**355,164.3**	**355,164.3**	**88,668.5**	**36,234.7**

Table E2. GRT7000 Screen of Soil Concentrations against derived SSTLs

GRT7000 - Chemical breakdown for screening	MSDS stated %	ERM Estimate of % for calculation	total product conc in soil (mg/kg)	Concentration in Soil	RBSLs	HQ
	%	%	mg/kg	mg/kg	mg/kg	
Alkyl acrylate-styrene copolymer	40-48%	24	3810	914.29	1642261.387	5.57E-04
		24	3810	914.29	277028.1488	3.30E-03
Water	40-50%	50	3810	N/A	N/A	N/A
Other non-hazardous ingredients	2%	2	3810	N/A	N/A	N/A
					HI	**3.86E-03**

N/A = the non-hazardous ingredients and water were not assessed.
HI = Hazard Index. This is defined in the body of the report.
Area Use Factor relates to the estimated time spent grazing adjacent to the roadway, in this case, 1% of the time
Mix of chemicals in the IBC and Water Truck have been taken from the most conservative estimates from Global Road Technology
Concentration in Soil was calculated based on the volumes applied according to manufacturers specifications
The concentrations for soil were based on 4 litres of solutions applied to a depth of 10cm and a soil density of 1.5 g/cm3

Table E3. GRT8000/9000 Screen of Soil Concentrations against derived SSTLs

GRT8000 - chemical breakdown for screening	% mix in product as per MSDS Sheet	total product conc in soil (mg/kg)	Concentration in Soil	RBSLs	HQ
	%	mg/kg	mg/kg	mg/kg	
Asphaltenes	15.55	3810	592.38	1997.24	2.97E-01
Hard resins	17.23	3810	656.19	355164.29	1.85E-03
Soft resins	10.64	3810	405.24	355164.29	1.14E-03
Oils	5.66	3810	215.71	355164.29	6.07E-04
Waxes	0.99	3810	37.62	355164.29	1.06E-04
Vanadium	0.0196375	3810	0.75	88668.54	8.44E-06
Nickel	0.0017175	3810	0.07	36234.74	1.81E-06
Styrene	15	3810	571.43	1642261.39	3.48E-04
Polymer Acid	15	3810	571.43	277028.15	2.06E-03
n-alkanes	5.84	3810	222.48	177582.15	1.25E-03
total % weight Low PAHs	1.19	3810	45.16	17758.21	2.54E-03
total % weight High PAHs	0.0005	3810	0.02	1997.24	9.77E-06
				HI	**9.93E-03**

The components of Bitumen have been broken down into ashphaltenes, hard resins, soft resins, oils, waxes, vanadium and nickel
The components of the emulsifier have been broken down into n-alkanes, low PAHs and high PAHs
HI = Hazard Index. This is defined in the body of the report.
Area Use Factor relates to the estimated time spent grazing adjacent to the roadway, in this case, 1% of the time
Mix of chemicals in the IBC and Water Truck have been taken from the most conservative estimates from Global Road Technology
Concentration in Soil was calculated based on the volumes applied according to manufacturers specifications
The concentrations for soil were based on 4 litres of solutions applied to a depth of 10cm and a soil density of 1.5 g/cm3

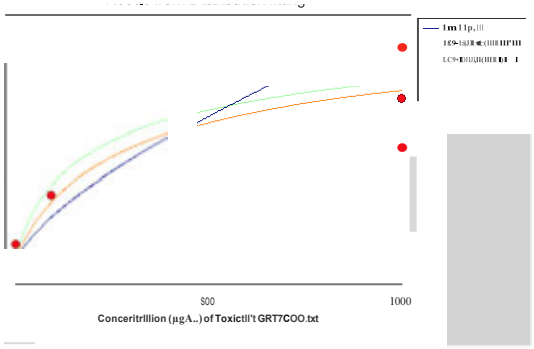
Table E4.GRT9000 Screen of Soil Concentrations against derived SSTLs

GRT9000 - chemical breakdown for screening	% mix in product as per MSDS Sheet	total product conc in soil (mg/kg)	Concentration in Soil	RBSLs	HQ
	%	mg/kg	mg/kg		
Asphaltenes	14.6170	3810	556.84	177582.15	3.14E-03
Hard resins	16.1915	3810	616.82	355164.29	1.74E-03
Soft resins	9.9993	3810	380.92	355164.29	1.07E-03
Oils	5.3228	3810	202.77	355164.29	5.71E-04
Waxes	0.9283	3810	35.36	355164.29	9.96E-05
Vanadium	0.0185	3810	0.70	88668.54	7.93E-06
Nickel	0.0016	3810	0.06	36234.74	1.70E-06
Styrene	15.00	3810	571.43	1642261.39	3.48E-04
Polymer Acid	15.00	3810	571.43	277028.15	2.06E-03
n-alkanes	5.84	3810	222.48	177582.15	1.25E-03
total % weight Low PAHs	0.81	3810	30.94	17758.21	1.74E-03
total % weight High PAHs	0.0005	3810	0.02	1997.24	9.77E-06
				HI	**8.90E-03**

The components of Bitumen have been broken down into ashphaltenes, hard resins, soft resins, oils, waxes, vanadium and nickel
The components of the emulsifier have been broken down into n-alkanes, low PAHs and high PAHs
HQ = Hazard Quotient. This is defined in the body of the report
HI = Hazard Index. This is defined in the body of the report.
Area Use Factor relates to the estimated time spent grazing adjacent to the roadway, in this case, 1% of the time
Mix of chemicals in the IBC and Water Truck have been taken from the most conservative estimates from Global Road Technology
Concentration in Soil was calculated based on the volumes applied according to manufacturers specifications
The concentrations for soil were based on 4 litres of solutions applied to a depth of 10cm and a soil density of 1.5 g/cm3

Annex F

Burrlioz Model Outputs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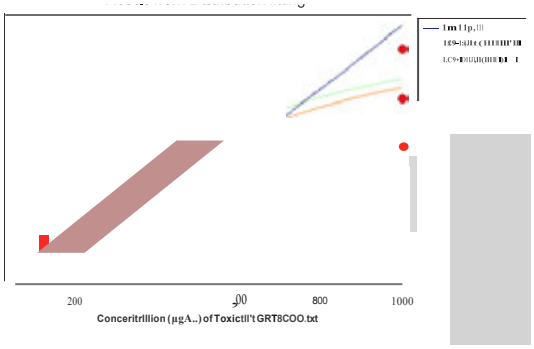
200
800
1000
Conceritrillion (µgA...) of Toxictll't GRT8COO.txt

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