Headland Agrochemicals Ltd, Pentre, Deeside

Groundwater Monitoring Programme Design

Report No F5035-15

September 2015

Carried out for:
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Report No F5035-15

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2 08/2015	Final report	NAME and QUALIFICATIONS Rebecca Fryer BSc (Hons) SIGNATURE	NAME and QUALIFICATIONS Darren Makin BSc (Hons) SIGNATURE	NAME and QUALIFICATIONS Melody Wareing BSc FGS SIGNATURE pp
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C O N T E N T S

1 INTRODUCTION

In June 2015, ESG was commissioned by Headland Agrochemicals Ltd, to carry out a review of available information for the Headland Agrochemical Ltd Deeside's manufacturing installation and to design a ground monitoring programme to meet the condition 3.1.3 Emissions to Water, attached to the installation's Environmental Permit EPR/FP/3031CW (dated 27 September 2013), namely:

"Periodic monitoring shall be carried out at least once every 5 years for ground water and 10 years for soil unless such monitoring is based on systemic appraisal of the risk of contamination."

This condition does not stipulate what Headland Agrochemicals have to carry out in terms of groundwater sampling and monitoring or the suite of parameters that the groundwater has to be tested for. Therefore, Headland Agrochemicals requires advice to establish a scope of works and design a monitoring programme to put forward to Natural Resources Wales for comment and approval prior to undertaking the works.

A previous site investigation has been carried out by Environmental Advice Centre (Report No J419a/V2/12.2001, dated December 2001). A copy of their report was made available to ESG for review as part of the study. A summary of this report and their main findings has been provided in Section 3.0.

2 SITE SETTING

2.1 Location and Description

The installation is located at the Pentre Works, Rectors Lane in Sandycroft, Flintshire at National Grid reference SJ328 676, as shown in the Site Location Plan presented in Appendix A.

The installation comprises an agrochemical manufacturing and blending / filling complex comprising:

- a raw material storage area;
- packaging and finished goods warehouse;
- raw material and in-process house;
- formulation;

- micro-nutrient filling Room;
- herbicide filling room;
- chemical storage tank farm;
- herbicide storage area;
- diesel Above Ground Storage Tank (AST); and
- offices, reception and laboratory.

The installation manufactures two products that together comprise one listed activity under Schedule 1, Part 2 of the Environmental Permitting (England and Wales) Regulations 2010 (as amended). The products (Headland Boron 150 and Headland Jett) are a listed activity because they involve the production of inorganic chemical salts.

The manufacturing plant is contained within a single warehouse type building made up from a series of adjoining buildings and offices. Almost the entirety of the site is laid to hardstanding with only minor areas of landscaping. An area of car parking is present within the western portion of the installation.

A small drainage channel bounds the northern perimeter of the installation. Emissions to water at the site comprise a solitary surface water discharge point controlled by an electrically pumped discharge controlled system situated in the north west of the facility.

A site layout plan illustrating the layout of the existing installation is presented in Appendix A.

The installation is situated in a mixed industrial and residential land use and is surrounded by light industrial units in all directions around the boundary. The Chester to Holyhead railway line runs parallel along the north eastern boundary of the installation.

2.2 Site Reconnaissance

A walkover was undertaken by a representative of ESG, accompanied by Headland Agrochemicals, on the 29 June 2015. The aim of this was to understand the activities that are conducted within the manufacturing process and to identify any evidence of actual or potential contaminating activities from either current or past land uses of the installation. A photographic record of the site walkover is presented in Appendix B.

On arrival, ESG was given a tour of the installation which comprised a complex of integrated buildings which formed a single building and a main courtyard. Inspection of the internal and external areas confirmed that the hardstanding surface remains in good condition indicating limited likelihood for a direct release of contaminants to groundwater (vertical migration) as most substances will be retained on the hard standing surface to allow recovery and act as a barrier to prevent migration into the site soil.

ESG was informed that the manufacturing processes undertaken in the installation generally involves the formulation and direct filling of products using raw materials retained on the installation which are then finished and packaged and stored for distribution.

The main production and chemical / raw material storage areas are situated along the northern flank of the building. The main production area comprised two extensive filling areas. The first of the filling area's was where the micro-nutrient product lines were prepared in the central part of the building. The second filling area was where the herbicide product lines were filled towards the north west of the building. Both micro-nutrients and herbicides were decanted into containers of various sizes within the purpose built filling facility.

In the north eastern corner of the facility was a formulation plant, an in-process warehouse and raw material store where the product lines were mixed prior to being fed along delivery lines to the filling points. There was some evidence of localised staining in this area due to the nature of the process but had been retained on the hardstanding at the time.

A tank farm comprising several double skinned above ground storage tanks containing acids, glycol, magnesium nitrate and monoethanolamine are located along the flank of the in-process area in the north east of the installation. The storage tanks were recently installed and there was no evidence of leakages or spillages.

Also along the northern flank of the process building was the herbicide storage area. Herbicides were stored in two 30, 0000 litre purpose built above ground storage tanks which were monitored and alarmed. The storage tanks had been recently commissioned and integrate modern PPC systems.

A waste disposal unit and compactor was situated in the external yard adjacent to west of the building.

The headworks of three of the four monitoring standpipes (BH1, 2 and 3) installed by EAC in 2001 were found to be intact and could potentially be retained as part of the final monitoring network if they are in a serviceable condition.

The material safety data sheets for all substances stored on the site have been provided by Headland Agrochemicals and a summary of chemicals used in the process has been listed in Table 1 below. A detailed chemical substance inventory for the site was not available at the time of writing. Material Safety Data Sheets for the substances (products as well as raw materials) are presented in Appendix C.

Based on the walkover and information supplied to ESG by Headland Agrochemicals, the following summarises the main substances currently stored and used in the manufacturing process.

TABLE 1. CHEMICAL INVENTORY FOR MAIN SUBSTANCES CURRENTLY USED IN THE INSTALLATION.

CHEMICAL MIXTURE / INGREDIENT	**USE**	**VOLUME STORED ON SITE AND CONTAINER TYPE**
Nitric Acid (60%)	Raw material used in the formulation of a variety of micro-nutrient products	Liquid / Above Ground Storage Tank Farm in north east / HDPE double skinned
Phosphoric Acid (75%)	Raw material used in the formulation of a variety of micro-nutrient products	Liquid / Above Ground Storage Tank north east / HDPE double skinned
Monoethanolamine	Raw material used in a variety of products	Liquid / Above Ground Storage Tank north east / HDPE double skinned
Copper powder	Raw material used in a variety of micro-nutrient products	Solid / Flexible Intermediate Bulk Containers (FIBCs) and small sacks / raw material warehouse
Manganese powder	Raw material used in a variety of products	Solid / FIBCs and small sacks / raw material warehouse
Magnesium nitrate	Raw material used in a variety of	Above Ground Storage

CHEMICAL MIXTURE / INGREDIENT	USE	VOLUME STORED ON SITE AND CONTAINER TYPE
	products	Tank north / Unknown
Zinc powder	Raw material used in a variety of products	Solid / FIBCs and small sacks / raw material warehouse
Ammonium nitrate	Raw material used in a variety of products	Solid / FIBC / External shipping container
Herbicides (2-methyl-4 chlorophenoxyacetic acid (MCPA), mecoprop and 4-(2,4 dichlorophenoxy) butyric acid (2-4 DB)	Raw product used in a variety of products	Liquid / Above Ground Storage Tank north / 30,000 litres
Fungicide (Tebuconazole and Epoxiconazole)	Raw product used in a variety of products	Liquid / IBCs / Finished goods warehouse
Diesel	Historically used to store red fuel and diesel to power generator	Liquid / 2700l carbon steel above ground storage tank
Boric Acid	Raw product for variety of products	Solid / in-process warehouse

In summary, the findings of the walkover indicate the following:

- The surface of the installation is in good condition with all internal and most operation external areas covered by intact concrete hardstanding;
- A few localised stains on the hardstanding from substances in the main production area;
- A range of potential sources of contamination exist on site, in particular bulk chemical above ground storage tanks containing herbicides and acids / nutrients located to the north of the installation (see Layout Drawing);
- Good housekeeping and pollution control practices were evident with evidence of secondary containment around existing ASTs; however it is understood that this was not present in the past prior to recent modernisation; and
- Three of the four monitoring standpipes installed in the EAC 2001 investigation remain intact and are present.

3.0 ENVIRONMENTAL SETTING

3.1 Published Geological Information

A summary of installation's environmental setting is presented below. A more detailed and comprehensive description is contained in EAC report detailed in Section 3.2 and the exploratory hole logs presented in Appendix D.

TABLE 2. SUMMARY OF PUBLISHED GEOLOGICAL MAPPING DATA AND BASELINE CONDITIONS

CHARACTERISTIC	DESCRIPTION
Made Ground	During the EAC 2001 investigation, surface cover of concrete and hardcore has been confirmed across the installation. Made Ground comprised ash stone and brick fill to a maximum depth of 1.5m (WS7).
Superficial Drift Deposits	The 1:50,000 scale geological map, Sheet 108 (Flint and BGS Geo Index 2015) indicates that the installation is underlain by Tidal Flat Deposits consisting clay, silt and sand. In the 2001 investigation, EAC encountered firm to stiff grey silty clay and brown and grey silty sand between 0.6 and 6.0m bgl during the intrusive phase of works.
Solid Geology	The 1:50,000 scale geological map, Sheet 108 (Flint and BGS Geo Index 2015) indicates that the installation is underlain by bedrock of both the Etruria Formation and the Pennine Middle Coal Measures which are divided along a geological boundary which transects the installation trending north west – south east. The solid geology to the west of the boundary is mapped as the Pennine Middle Coal Measures which comprise sequences of interbedded mudstones, siltstones and sandstone. The solid geology to the east of the boundary is mapped as the Etruria Formation which comprises a sequence of interbedded mudstone, sandstone and conglomerate.

TABLE 3. SUMMARY OF PUBLISHED HYDROGEOLOGICAL AND HYDROLOGICAL MAPPING DATA

CHARACTERISTIC	DESCRIPTION
Superficial Deposits Aquifer Classification	Published information from the Environment Agency Groundwater Vulnerability Map, Sheet 16 West Cheshire, indicates that the installation site is on a Minor Aquifer. Now classified as a Secondary B Aquifer on the Environment Agency Interactive website.
Solid Geology Aquifer Classification	Secondary A Aquifer.
Source Protection Zones	The site is not located within a Source Protection Zone III (total catchment).
Groundwater Vulnerability Zone	Minor Aquifer High.
Groundwater	Groundwater was encountered in the EAC 2001 investigation in the superficial Tidal Flat deposits between 1.73 and 2.19 m bgl. Information provided to the EAC (EAC 2001) by the Environment Agency has confirmed that the groundwater flow direction in the superficial deposits (Secondary B aquifer) is to the north towards the River Dee but it is possible that groundwater discharges into the drainage cutting along the northern boundary (See below).
Hydrology	Sandycroft Drainage Ditch runs along the northern boundary of the installation and discharges into the River Dee, located approximately 500m to the north of the installation.

3.2 Previous Investigation

Environmental Advice Centre 2001

In November 2001, the Environmental Advice Centre (EAC) Ltd undertook a site investigation and contamination assessment of the installation prior to acquisition and occupation of the site by Headland Agrochemicals (See Appendix B). The purpose of the investigation was to establish the environmental setting, characterise the soil and groundwater and establish baseline levels of contaminants as part of a due diligence process for acquisition of the site and to determine the significance of any contamination found.

The investigation comprised two phases of work, a desk based review of information for the installation and a Phase 2 intrusive works.

The desk based study included a review of historical land use data (1870 to 1992) which indicated that the installation had not been occupied by significant potentially contaminating land uses since the earliest record. In the report it was suggested that the potential sources of contaminative sources prior to acquisition were limited to the operation of a bakery and later (1966 – 1998) as a food storage and distribution centre (incorporating a small vehicle and service maintenance facility).

A phase of intrusive works was scoped by EAC to target potential area's of contamination which included a former oil storage area to ensure there had been no migration of hydrocarbon contamination over times of operation due to leakages. The remaining holes were positioned to provide coverage of the installation.

The investigation comprised the advancement of four light cable percussive boreholes to maximum depths of 6.0m bgl and nine window samples to maximum depths of 3.0m bgl with associated soil chemical testing for a broad suite of general contaminants (heavy metals and metalloids (arsenic, cadmium, chromium, copper, lead, nickel, mercury, zinc and boron), total sulphate, ammonia, pH value, phenols, PAHs and total petroleum hydrocarbons). Three selected samples were analysed for asbestos.

All four boreholes were completed with 50mm HDPE standpipes to allow groundwater samples to be collected. These were sampled and tested for the same suite of contaminants as for the soil samples during a single post investigation groundwater sampling/ground gas monitoring visit.

The EAC report indicated that no olfactory or visual evidence of contamination in the soil or groundwater was encountered during the site investigation with the exception of hydrocarbon staining visible on the external walls of a building adjacent to a former Above Ground Storage Tank.

Analytical results for the soil samples were assessed against ICRCL trigger values for buildings and hard cover values and open space (for metals as no generic assessment criteria (GACs) for proposed land use was available at the time). It should be noted that although the GACs used in the assessment were appropriate for the time, these have since been superseded and are no longer acceptable health protective screening criteria). The assessment indicated elevated isolated exceedances of the ICRCL for open space and allotments for zinc (phytotoxic), mercury and chromium in the soil samples tested.

Assessment of contaminant concentrations in the groundwater indicated minor exceedances of the GACs for ammonia (BH1 and BH3 0.3 to 8.1mgl respectively). Detectable concentrations of the herbicide MCPA were recorded in both locations where tested (BH1 and BH3) and concentrations of TPH, copper, phosphate nitrite and nitrate were below or marginally above the limits of detection.

EAC concluded in their report that:

- Intrusive investigation with boreholes and window samples found no obvious odours, staining or colouration to made ground or soils;
- A low degree of contamination within the made ground, believed to be due to ash and clinker, within fill materials imported to the site and laid beneath the building and external hard standing;
- Contamination status will pose no significant risk to future users of the site, services or property in the context of continued industrial use and limited remedial action would be required if a significant change in use was planned;
- No evidence of groundwater contamination by TPH's, PAH's and no significant concentrations of acid herbicides were found; and
- The fill materials in which limited contamination of heavy metals and sulphates was found do not demonstrate significant leaching potential. Therefore do not have the capacity to cause significant contamination of groundwater or surface waters.

It should be noted that whilst the report provides the baseline for a general range of contaminants it did not establish baseline soil and groundwater concentrations for a range of the source substances identified in the inventory for the installation.

4 INITIAL CONCEPTUAL SITE MODEL

4.1 General

In line with existing legislation and the current permitting regime assessments are undertaken using a risk based approach. It is necessary to define an initial Conceptual Site Model (CSM) for the site which identifies the potential sources of contamination, the receptors and the pathways that can connect them. In order for there to be a risk from contamination, one or more relevant

pollutant linkages must exist, connecting a contamination source, a receptor (an entity which might be affected by the contamination) and a pathway (or mechanism) by which the receptor can be exposed to the contaminants.

A discussion of potential sources, pathways and receptors and a tabulated summary of the CSM indicating potential pollutant linkages for the water environment follow below. The criteria used for assessing the relevance of identified potential pollutant linkages are based on the objectives stated above.

4.2 Potential Sources of Contamination

Potential sources of contamination are usually associated with current and former industrial activities, where the processing, storage, use, transportation and disposal of raw materials, products and wastes often leads to the contamination of underlying ground and groundwater. In addition, natural processes can also give rise to contamination such as hazardous gases.

Based on the information presented above, potential sources of contamination from current and historical site uses have been assessed. Potential sources of contamination and contaminants at and within the installation boundary are summarised in the table below. These are based in the data obtained and published guidance.

TABLE 4 POTENTIAL SOURCES OF CONTAMINATION

SITE USE / ACTIVITY AND AREA	SOURCES	CONTAMINANTS
External northern tank farm in the north east of installation	Above ground storage tank farm and delivery lines and filling plant / area	Magnesium, acids, ethylene glycol and ethanolamine
External bunded modern tank farm to the north (central part) of the production facility	Above ground storage tanks and delivery lines and filling plant / area	Herbicides (MCPA, mecoprop and 4-(2.4-dichlorophenoxy)butyric acid and tebuconazole)
Internal above ground storage tank located in the north western corner of building and second AST in central north of the installation	Above ground diesel storage tank and lines	Aliphatic and aromatic hydrocarbons and PAHs
Raw material warehouse	FIBCs and sacks of substances	Copper and zinc
Finished goods Warehouse	IBCs	Fungicides (Tebuconazole and Epoxiconazole)
In-process warehouse	Sacks	Boric acid
External shipping container	FIBCs	Ammonium nitrate

4.3 Potential Migration Pathways (Controlled Waters)

The following potential pathways have been identified as potential migration pathways:

- Leaching of contaminants from soils into soil pore water and shallow groundwater following rainfall infiltration.
- Downward migration of soil pore water and shallow groundwater towards groundwater body in the underlying bedrock.
- Lateral groundwater flow including migration off-site.

4.4 Potential Receptors (Controlled Waters)

- Groundwater in the underlying superficial deposits (Secondary B Aquifer).
- Groundwater in the underlying bedrock (Secondary A Aquifer).

- Surface water (Sandycroft Drainage Ditch) adjacent to the north.
- Surface water (River Dee) approximately 500m to the north of the installation.

4.5 Summary

The relevant pollutant linkages based on the potential sources, pathways and receptors outlined above are tabulated below:

TABLE 5 INITIAL CONCEPTUAL SITE MODEL (CONTROLLED WATERS)

SOURCE	PATHWAY	RECEPTOR
Potentially elevated concentrations of contaminants associated with the current land uses on site (agrochemical production)	• Leaching and downward migration of groundwater • Lateral groundwater migration	• Groundwater in the superficial deposits • Groundwater in the underlying bedrock • Sandycroft Drainage Ditch • River Dee
General Made Ground from previous land use prior to occupation	• Leaching and downward migration of groundwater • Lateral groundwater migration	• Groundwater in the superficial deposits • Groundwater in the underlying bedrock • Sandycroft Drainage Ditch • River Dee

There are currently a series of uncertainties and assumptions in the CSM presented above as this is based on desk study information and time elapsed since the EAC due diligence investigation was undertaken.

- Ground conditions have been conceptualised based on BGS geological maps and other primarily desk based information.
- The installation has occupied and been operated on the site since 2001.
- The presence and extent of any suspected contamination is unknown in the absence of site investigation data as no investigation or monitoring has been undertaken since 2001.

5 PROPOSED MONITORING PROGRAMME / INVESTIGATION

Based on the above information and walkover findings, ESG considers that samples of groundwater from the underlying Tidal deposits will have to be collected and tested to characterise the current contamination status and to comply with the EPR condition 3.1.3 for Emissions to Water.

At present, ESG considers that only the groundwater quality beneath the installation in the superficial deposits (aquifer) will need to be investigated rather than deeper groundwater in the underlying bedrock.

5.1 Scope of Works

On this basis, the requirements needed to fulfil the conditions relating to emissions to groundwater in the Environmental permit, ESG recommend the following scope of works:

- Liaison with NRW to seek approval of scope;
- Inspect the condition of the existing borehole network to ascertain if they are serviceable (i.e. have not silted up) and that a representative sample of groundwater can be taken from the standpipes and can be included in the monitoring network;
- Rehabilitate the EAC boreholes which are not in a serviceable condition;
- Intrusive investigation comprising the excavation of window sample and light cable percussive boreholes to create a monitoring network to augment the existing boreholes, if they remain in a satisfactory condition or replace if not;
- Limited soil sampling and testing for the range of contaminants detailed in the CSM;
- Routine groundwater monitoring and collection of groundwater samples for chemical analysis; and
- Provision of a factual report to detail the current groundwater conditions.

A typical scope of works will require the installation of a perimeter groundwater monitoring network to include a further five monitoring points to augment the existing EAC boreholes remaining on site (subject to their condition and serviceability).

The monitoring network should comprise at least two upgradient monitoring points and a further three down gradient monitoring points to determine the flow direction of groundwater in the aquifer

and take samples of groundwater down gradient of the potential sources identified. This will allow comparison of the groundwater water quality entering and leaving the site i.e. up gradient and down gradient.

All proposed groundwater monitoring points should be furnished with raised upstand covers and situated away from direct sources of contaminants which in the event of a spillage / incident could migrate directly into the groundwater through the preferential pathway created.

A groundwater quality monitoring programme comprising an initial three monitoring visits over a twelve month period should be sufficient to characterise the groundwater. It is proposed that the first monitoring visit will be undertaken following the installation of the monitoring points and followed up with a second monitoring visit three months later. A third visit should be undertaken twelve months from the first visit.

On each monitoring visit, samples of groundwater are to be collected from each monitoring well (total of eight samples on each visit) in accordance with methodologies described the EA guidance document TGN02 *Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water.*

Samples of the site soil and groundwater should be initially tested for the same suite of source contaminants as identified in the Conceptual Site Model (the same parameters currently tested on the site drainage water samples). The groundwater should be analysed for the following parameters:

- Total and dissolved metals (copper, manganese, phosphorous and zinc);
- Sulphate, nitrate and nitrite and ammoniacal nitrogen;
- Free residual chlorine;
- pH value;
- SVOCs (with tentatively identified compounds);
- 1,2 benzisothiazolin-3-one;
- Monoethanolamine (alcohol suite);
- Monoethylene glycol (glycol suite); and
- Pesticides including MCPA, Mecoprop, 2,4 DB, Tebucanazole and Epoxiconazole

In addition to the above surface water suite, speciated aliphatic and aromatic hydrocarbon, dissolved and total boron should also be tested.

5.2 Reporting

On completion of the site investigation and first monitoring visit, a factual report which will describe the intrusive works and initial ground water conditions of the installation will need to be submitted to Natural Resources Wales.

Following each of the proposed monitoring visits, a report should also be prepared to describe the monitoring works undertaken, present the concentrations of the potential source contaminants and make recommendations if the monitoring programme should be revised or extended.

REFERENCES

BGS England and Wales Sheet 108. Flint 1:50000 geological map (solid and drift) (Bedrock and Superficial). British Geological Survey.

BGS Geology of Britain Viewer : 2015. www.bgs.ac.uk. August 2015. British Geological Survey.

Environment Agency. In My Backyard Viewer: 2015.www.environment-agency.gov.uk

Environmental Advice Centre. Headland Agrochemicals Ltd. Contamination Assessment. Proposed Site, Rectors Lane, Sandycroft.

Environment Agency. Technical Guidance Note 02 Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water.

Defra. Environmental Permitting Guidance. Core Guidance for the Environmental Permitting (England and Wales) Regulations 2010.

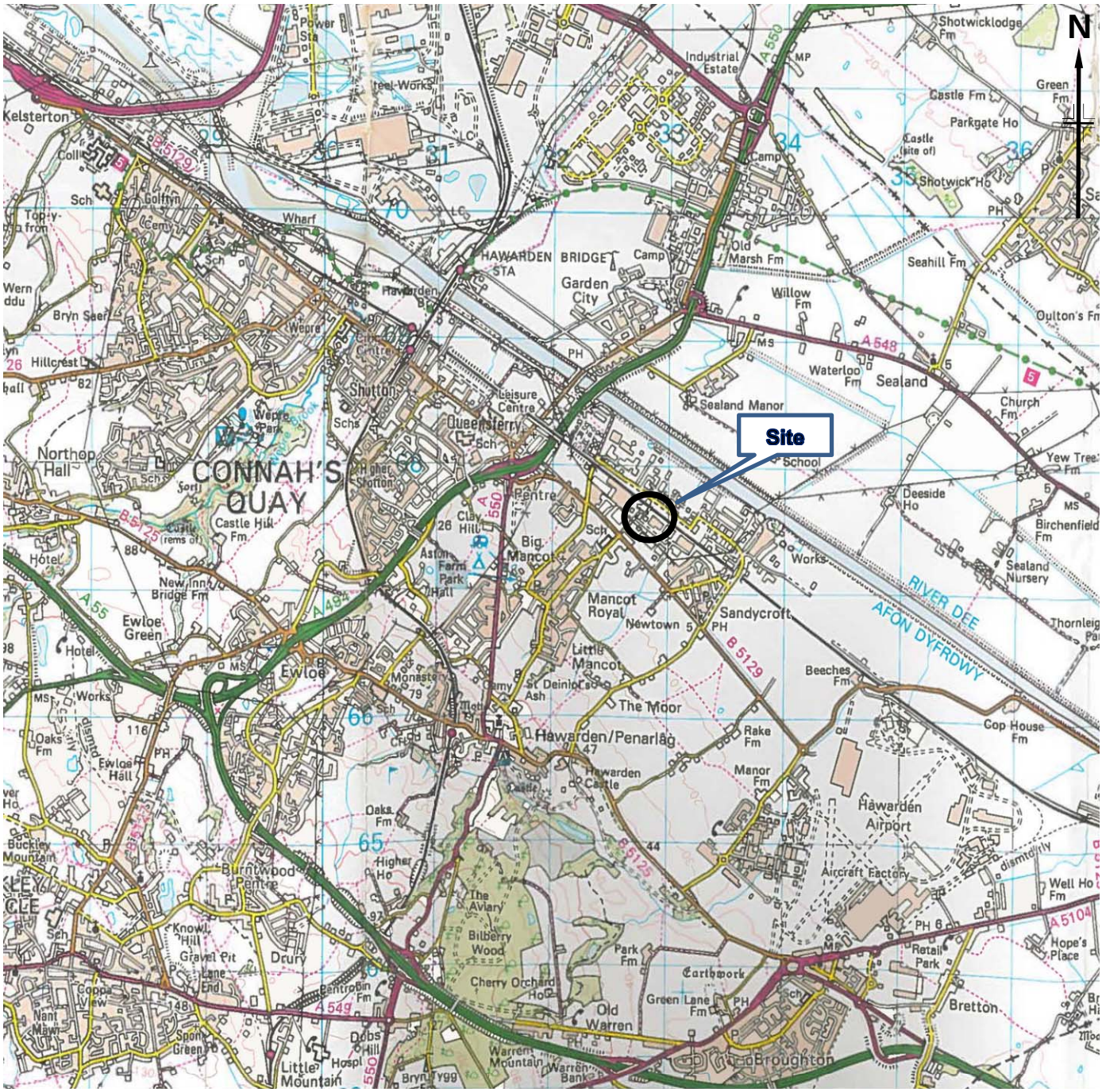
APPENDIX A

FIGURES AND DRAWINGS

Site Location Plan

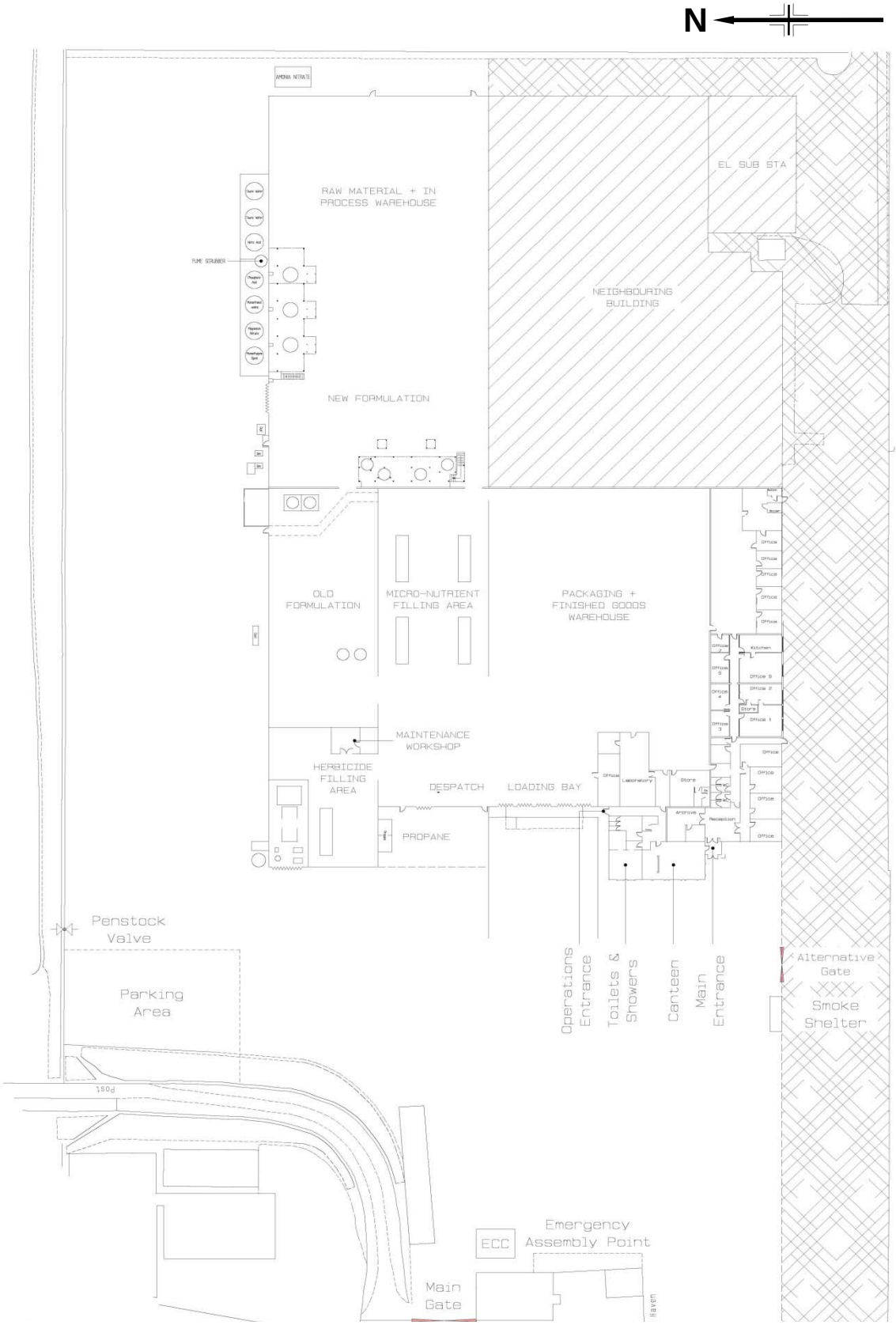
Site Layout Plan

Site Plan



Notes: Not to scale	**Project**	**Groundwater Monitoring Programme Design**	**Figure** **A1**
	Project No.	**F5035-15**	
	Carried out for	**Headland Agrochemicals Ltd**	

Site Plan



Notes: Not to scale	**Project** Groundwater Monitoring Programme Design **Project No.** F5035-15 **Carried out for** Headland Agrochemicals Ltd	**Figure** **A2**

APPENDIX B
WALKOVER PHOTOGRAPHS

Photographs

Packaging and Finished Goods Warehouse

Micro-nutrient Bottle Filling Facility – note condition of ground slab and good level of house keeping

Notes:	Project	Groundwater Monitoring Review	Plate
	Project No.	F5035-15	1
	Carried out for	Headland Agrochemicals Ltd	

Photographs

Herbicide Product Filling Facility

Former Herbicide Storage Area

Notes:	Project	Groundwater Monitoring Review	Plate
	Project No.	F5035-15	2
	Carried out for	Headland Agrochemicals Ltd	

Photographs

Courtyard Area in North-Western Corner of the Installation

Formulation / In-process Warehouse

Notes:	Project	Groundwater Monitoring Review	Plate
	Project No.	F5035-15	3
	Carried out for	Headland Agrochemicals Ltd	

Photographs

Herbicide Above Ground Storage Tank

Notes:	Project	Groundwater Monitoring Review	Plate
	Proiect No.	F5035-15	4
	Carried out for	Headland Agrochemicals Ltd	

Photographs

AST Containing Diesel and Power Generator

Purpose Built Chemical Storage Tank Farm (ASTs)

Notes:	Project	Groundwater Monitoring Review	Plate
	Project No.	F5035-15	5
	Carried out for	Headland Agrochemicals Ltd	

APPENDIX C
MATERIAL SAFETY DATA SHEETS

APPENDIX 3

PHYSICAL & TOXICOLOGICAL PROPERTIES OF DANGEROUS SUBSTANCES

Material Description	Promex NA20 S	RUBRIC 5910 4x2.5L GB	Epoxiconazole 5910 1000L	Fluazinam 500SC 5810 1000L mo
CAS - No.	2634-33-5	133855-98-8	133855-98-8	79622-59-6
IUPAC Nomenclature	1,2-Benzisothiazolin-3-one	(2RS,3SR)-1-[3-(2-Chlorophenyl)-2,3-epoxy-2-(4-fluorophenyl)-propyl]-1H-1,2,4-triazole	(2RS,3SR)-1-[3-(2-Chlorophenyl)-2,3-epoxy-2-(4-fluorophenyl)- propyl]-1H-1,2,4-triazole	3-Chloro-N-(3-chloro-5-trifluoromethyl-2-pyridyl)-α,α,α-trifluoro- 2,6-dinitro-p-toluidine
Chemical Formula or Composition	1,2-benzisothiazolin-3-one & Sodium hydroxide	Epoxiconazole	Epoxiconazole	Sodium alkyl naphthalene sulphonate formaldehyde condensate & Alcohols, C_{13}-C_{15}, ethoxylated & 1,2-Benzisothiazol- 3(2H)-one
Risk Phrase	R50	R50	R50	R50
Odour	Very Faint	Aromatic odour	Characteristic aromatic odour	Practically odourless
Flash Point	> 100°C	>200°C	>200°C	> 103°C
Boiling Point	> 100°C	> 100°C	> 100°C	>100°C
Vapour Pressure	0.9kPa @ 25°C	< 1.0 x 10^{-5} Pa at 20°C	Unknown	1.1 x 10^{-3} Pa at 20°C
Toxicity	Oral LD50 (rat): 6,000mg/kg Fish (rainbow trout) LC50 (96 h) = 6.5 mg/L, Fish (Bluegill sunfish) LC50 (96 h) = 17 mg/l Daphnia EC50 (48 h) = 5.5 mg/l Algae EC50 (96 h) = 0.42 mg/l Low potential for bioaccumulation	Acute oral Acute oral LD50:>2,000 mg/kg (rat) Epoxiconazole is very toxic to aquatic plants, fish and aquatic invertebrates. LC 50 96 hour Rainbow trout 1.1 mg/litre 48 hour EC50 Daphnia magna 0.63 mg/l 72 hour EC50 Green algae (Desmodesmus) 0.010 mg/l	Acute oral Acute oral LD50:>2,000 mg/kg (rat) Epoxiconazole is very toxic to aquatic plants, fish and aquatic invertebrates. 96 hour LC50 Rainbow trout 1.1 mg/litre 48 hour EC50 Daphnia magna 0.63 mg/l 72 hour ;EC50 Green algae (Desmodesmus) 0.010 mg/l	LD50, oral, rat: > 2,000 mg/kg Very toxic to fish and other aquatic organisms. Fish Rainbow trout (*Oncorhynchus mykiss*) 96-h LC50: 0.163 mg/l, Daphnids (*Daphnia magna*) 48-h EC50: 0.23 mg/l Green algae (*Desmodesmus subspicatus*) 96-h IC50: 0.039 mg/l (*Lemna gibba*) 7-day 0.57 mg/l Birds Japanese quail (*Coturnix coturnix japonica*) LD50: > 2000 mg/kg Earthworms *Eisenia foetida* 14-day LC50: > 1000 mg/kg dry soil Bees Honeybee (*Apis mellifera*) 48-h LD50, contact: > 100 µg/bee 48-h LD50, oral: > 100µg/bee Fluazinam is biodegradable

Material Description	Tebuconazole 250EW 1652 1000L cx	COPPER OXYCHLORIDE 58%	COPPER SULPHATE
CAS - No.	107534-96-3	1332-40-7	7758-98-7
IUPAC Nomenclature	(RS)-1-p-chlorophenyl-4,4-dimethyl-3-(1H-1,2,4-triazol- 1-ylmethyl)pentan-3-ol	Copper Oxychloride	Copper Sulphate
Chemical Formula or Composition	Tebuconazole Technical	$Cu(OH)_3Cl$	$CuSO_4$
Risk Phrase	R50	R50	R50
Odour	Coco oil-like	Light	Barely perceptible odour
Flash Point	75°C	None	None
Boiling Point	Not available	Undetermined	Unknown
Vapour Pressure	<1kPa 20°C	1×10^{-7}	Unknown
Toxicity	Acute oral LD50:>2,000 mg/kg (rat) The product is toxic to aquatic plants, harmful to fish & aquatic invertebrates Fish Rainbow trout (*Oncorhynchus mykiss*) 96-h LC50 17.7 mg/l; Invertebrates Daphnids (*Daphnia magna*) 48-h EC50 21.5 mg/l; Algae Green algae (*Desmodesmus subspicatus*) 72-h EC50 0.110 mg/l Birds Japanese quail (*Coturnix coturnix japonica*) 14-day LD50 > 2000 mg/kg; Earthworms *Eisenia foetida* 14-day LC50 > 1000 mg/kg dry soil Bees Honey bee (*Apis mellifera*) 48-h LD50, oral > 100 µg/bee 48-h LD50, contact > 100 µg/bee	Acute oral LD50:700-800 mg/kg (rat) EC50 (48h) 0.5mg/l (daphnia magna) EC50 (72h) 0.033mg/l (algae) LC50 (96h) >43.8mg/l (rainbow trout)	Acute oral LD50 > 5,000 mg/kg (rat) Readily absorbed into soil. This substance is not identified as a PBT substance. Ecotoxicity in water (LC50): 0.1 ppm 48 hours [Goldfish]. 0.1 mg/l 96 hours [Rainbow Trout] 2.5 mg/l 96 hours [Rainbow trout] Toxic to aquatic organisms

Material Description	BUTOXONE BULK	ZINC LQD BULK	ZINC 700 Triachem 2x5L TZ
CAS - No.	6062-26-6	7733-02-0	1314-13-2
IUPAC Nomenclature	[4-(4-chloro-o-tolyloxy)butyric acid]		
Chemical Formula or Composition	MCPB [4-(4-chloro-o-tolyloxy)butyric acid] $C_{10}H_{10}Cl_2O_3$	Zinc Sulphate & Ethylene Glycol	Zinc Oxide & Ethylene Glycol
Risk Phrase	R50	R50	R50
Odour	Characteristic, slight phenolic odour	Barely perceptible odour	Barely perceptible odour
Flash Point	None	None	None
Boiling Point	>100°C	>100°C	>100°C
Vapour Pressure	Negligible	Unknown	Unknown
Toxicity	Acute oral LD50: >500 mg/kg (rat) LC50 (96 hour): Rainbow trout 3.9 mg/litre LC50 (48 hour): *Daphnia* 50.1 mg/litre EC50 (72 hour): Algae 1.5 mg/l EC50 (17 days): Duckweed (*Lemna gibba)* 37 mg/l Behaviour in soils: Rapidly degraded in soils (dt50=6.8 days). Low bioaccumulation potential (based on log Pow) Koc = 86-130 Not persistent or bioaccumulating	Acute oral LD50: 2,150 mg/kg (rat) Eco toxicological data LC50 96 hours fish (rainbow trout) 7.2mg/l EC50 48 hours Daphnia 4.7mg/l Very toxic to aquatic organisms	Acute oral LD50 :100 mg/kg (mouse) IC50 (72h) algae 0.41mg/l

Material Description	Agroxone	LEGUME MIX BULK	TRICE (MN,CU,ZN) BULK	TRANSFER
CAS - No.	94-74-6	7785-87-7 7733-02-0	1332-40-7	5221-16-9
IUPAC Nomenclature	(MCPA) 2-methyl-4-chlorophenoxyacetic acid			
Chemical Formula or Composition	MCPA & 4-chloro-2 methyl phenol	Managanese Sulphate & Zinc Sulphate (each 5-20%)	Copper Oxychloride & Zinc Oxide & Ethylene Glycol	CMPP-P & MCPA & Dicamba
Risk Phrase	R50	R51/53	R51/53	R50
Odour	Characteristic Odour	Barely perceptible odour	Barely perceptible odour	Characteristic, phenolic
Flash Point	>110°C	None	None	>100°C
Boiling Point	>100°C	Unknown	Unknown	>100°C
Vapour Pressure	Unknown	Unknown	Unknown	Negligible
Toxicity	Acute oral LD50:1239 mg/kg (rat) LC50 96 hours fish (rainbow trout) 99.3 mg/l IC50 72 hours algae 60.7mg/l LC50 48 hours Daphnia 425 mg/l Very toxic to aquatic organisms	Acute oral LD50:1710 mg/kg (rat) LC50 96 hours fish (rainbow trout) 19.2 mg/l LC50 48 hours Daphnia 13.5mg/l IC50 72 hours algae 1.3mg/l Very toxic to aquatic organisms	Acute oral LD50: >5,000mg/kg (rat) EC50 (72h) algae 0.31mg/L	Fish LC50 (96hr) for rainbow trout is 50 mg/l for MCPA potassium salt LC50 (96hr) for rainbow trout is 26 mg/l for picloram potassium salt EC50 (48hr) for daphnia is >190 mg/l for MCPA potassium salt. EC50 (48hr) for daphnia is 63.8 mg/l for picloram potassium salt. LC50 for algae is >392 mg/l for MCPA potassium salt EC25 for algae is 52.6 mg/l for picloram potassium salt Not toxic to birds Not toxic to bees

Material Description	Fenox69/Cloq34,5 4960 900L	2, 4-D 500 Herboxone	OSKAR X 3L	Foxtrot 4960 4x3L GB
CAS - No.	71283-80-2	2008-39-1	71283-80-2	71283-80-2
IUPAC Nomenclature	fenoxaprop-p-ethyl	Aqueous solution of Dimethylamine salt of 2-(2-4-Dichlorophenoxy) acetic acid	fenoxaprop-p-ethyl	(R)-Ethyl 2-[4-[(6-chloro-2-benzoxazolyl)oxy] phenoxy] propanoate
Chemical Formula or Composition	An oil-in-water emulsion containing fenoxaprop-p-ethyl	(2,4 Dichlorophenoxy) Acetic Acid, Dimethylamine Salt	An oil-in-water emulsion containing fenoxaprop-p-ethyl	
Risk Phrase	R51/53	R51/53	R51/53	R51/53
Odour	Aromatic	Characteristic odour	Characteristic aromatic odour	Aromatic
Flash Point	>100°C	>200°C	> 100°C	>100°C
Boiling Point	Approx. 100°C	>100°C	Approx. 100°C	Approx. 100°C
Vapour Pressure	5.3×10^{-7} Pa	Unknown	Unknown	5.3×10^{-7} Pa
Toxicity	Acute oral LD50: >2,000 mg/kg (rat) Rainbow trout: 96-hour LC50 = 3.83 mg/litre *Daphnia magna*: 48-hour EC50 = 3.1 mg/litre *Desmodesmus spp.* 72-hour EC50 = 5.37 mg/litre	Acute oral LD50 = 1297 mg/kg (rat) Fairly mobile, but rapidly degraded in aerobic soils. Rapidly degraded in aerobic soils (aerobic half life 3-10 days). Potential for bioaccumulation is low based on log Pow. (log Pow 2,4-D = 0.91 at pH 7). LC50 96hr Rainbow Trout = >200mg /l LC50 72hr algae = 178mg /l	Acute oral LD50: >2,000 mg/kg (rat) Rainbow trout: 96-hour LC50 = 3.83 mg/litre *Daphnia magna*: 48-hour EC50 = 3.1 mg/litre *Desmodesmus spp.* 72-hour EC50 = 5.37 mg/litre	Acute oral LD50 >2000 mg/kg (rat) Fish Rainbow trout (*Oncorhynchus mykiss*) 96h LC50 3.83 mg/l Invertebrates Daphnids (*Daphnia magna*) 48h LC50 3.1 mg/l Algae Green algae (*Desmodesmus subspicatus*) 72h EC50 1.85 mg/l Birds Bobwhite quail (*Colinus virginianus*) LD50 > 2250 mg/kg Plants Duckweed (*Lemna gibba*) 7-day LC50 4.3 mg/l Earthworms *Eisenia fetida* 14-day LC50 356.6 mg/kg dry soil Bees Honey bee (*Apis mellifera* L.) 72h LD50, contact 599 µg/bee 48h LD50, oral 356 µg/bee Fenoxaprop-P-ethyl is biodegradable

Material Description	MANGANESE SULPHATE - BOM	VERDICROP HUMAN 15 + 1%Zn Bulk	Manganese 15-16% Bulk	MANGANESE 17%
CAS - No.	10034-96-5	7785-87-7	7785-87-7	7785-87-7
IUPAC Nomenclature	Manganese Sulphate	Manganese Sulphate	Manganese Sulphate	Manganese Sulphate
Chemical Formula or Composition	$MnSO_4$	Manganese Sulphate & Ethylene Glycol	$MnSO_4$	$MnSO_4$
Risk Phrase	R51/53	R51/53	R51/53	R51/53
Odour	Odourless	Characteristic Odour	Barely perceptible odour	
Flash Point	None	None	None	None
Boiling Point	Unknown	Unknown	Unknown	Unknown
Vapour Pressure	Unknown	Unknown	Unknown	Unknown
Toxicity	Acute oral LD50: 2,150 mg/kg (rat) LC50 96 hours fish (rainbow trout) 3.17 mg/l EC50 72hr (algae) 10.5mg/l LC50 48 hours Daphnia 9.8mg/l Very toxic to aquatic organisms	Acute oral LD50 = 2,150 mg/kg (rat) Readily absorbed into soil. This substance is not identified as a PBT substance	Acute oral LD50: 2,150 mg/kg (rat) LC50 96 hours fish (rainbow trout) 9.27mg/l EC50 72hr (algae) 30.7mg/l LC50 48 hours Daphnia 28.7mg/l Very toxic to aquatic organisms	Acute oral LD50: 2,150 mg/kg (rat) LC50 96 hours fish (rainbow trout) 8.48 mg/l EC50 72hr (algae) 28.1mg/l LC50 48 hours Daphnia 26.2mg/l

Material Description	Fruit ZM 20L (SOC) MA	ManZinc Bulk	RHINO X 1L
CAS - No.	7785-87-7 7733-02-0	1314-13-2	134180-76-0
IUPAC Nomenclature	$MnSO_4$, $CuSO_4$	ZnO	$(CH_3)_3SiO[(CH_3)_2SiO]_a[(CH_3)SiO]_bSi(CH_3)_3$ $(CH_2)_3$ $(OC_2H_4)_c(OC_3H_6)_dR^1$
Chemical Formula or Composition	Managanese Sulphate & Zinc Sulphate (each 5-20%)	Zinc Oxide & Ethylene Glycol	Polyether modified polysiloxane
Risk Phrase	R51/53	R51/53	R51/53
Odour	Barely perceptible odour	Barely perceptible odour	Characteristic odour
Flash Point	None	None	>102°C
Boiling Point	Unknown	Unknown	Unknown
Vapour Pressure	Unknown	Unknown	Unknown
Toxicity	Acute oral LD50: 1,710 mg/kg (rat) LC50 96 hours fish (rainbow trout) 19.2 mg/l EC50 72hr (algae) 1.3mg/l LC50 48 hours Daphnia 13.5mg/l Very toxic to aquatic organisms	Acute oral LD50 > 2,000 mg/kg (rat) Readily absorbed into soil This substance is not identified as a PBT substance	Acute oral LD50 = 3,200 mg/kg (rat) Rainbow Trout (Oncorhynchus mykiss) LC50 2.1 mg/l Daphnia magna EC50 1.1 mg/l Scenedesmus Subspicatus EC50 152.2 mg/l Not biodegradable Mobility: Readily absorbed into soil This substance is not identified as a PBT substance

Material Description	SAXON	DiFarmon	2,4 DB
CAS - No.	16484-77-8	10484-77-8	94-82-6
IUPAC Nomenclature	Mecoprop-p 46.3 % w/w	(R)-2-(4-chloro-o-tolyloxy) propionic acid, dimethylamine salt	4-(2, 4-dichlorophenoxy) butyric acid
Chemical Formula or Composition	Mecoprop-P, Dicamba	CMPP-P, Dicamba, potassium hydroxide	$C_{10}H_{10}Cl_2O_3$
Risk Phrase	R51/53	R51/53	R51/53
Odour	Characteristic Phenolic Odour	Faint Phenolic	Characteristic, Phenolic
Flash Point	> 200°C	>100°C	>100°C
Boiling Point	112°C	>100°C	>100°C
Vapour Pressure	Unknown	Unknown	Unknown
Toxicity	Acute oral LD50 435-1,050mg/kg (rat) Toxicity to birds:497 mg/kg bw (mecoprop-p) 2000 mg/kg bw (8-day) (dicamba) Non-toxic to bees Toxicity to fish:96-hr LC50 >100 mg/l (mecoprop-p) 96-hr LC50 135.4 mg/l (dicamba) Toxicity to *Daphnia:* 48-hr EC50 >91 mg/l (mecoprop-p) 48-hour EC50 110.7 mg/l (dicamba) Toxicity to algae: 72-hr EC50 16.2mg/l (mecoprop-p) 72-hr EC50 >3.7 mg/l (dicamba) Persistence and biodegradability: Soil DT50 = 6.3-8.2 days (mecoprop-p) Soil DT50 – 2.1-8 days (dicamba)	Acute oral LD50: >667 mg/kg (rat) LC50 (96 hour): fish 127mg/litre EC50: (72 hours) Algae 16.2mg/litre LC50: *Lemna* 14 mg/litre EC50 (48-hour): *Daphnia* 272 mg/litre Mobility in soil: Fairly mobile but rapidly degraded Persistence in soil: Quickly degraded in aerobic conditions (t/2=24 days) Bio-accumulation: Low potential	Acute oral LD50: >667 mg/kg (rat) LC50 (96 hour): Rainbow trout 17.8 mg/litre EC50 (48 hour): Daphnia 21.2 mg/litre EC50 (72 hour): Algae 54.6 mg/l (*Selanastrum)*, 29 mg/l (*Lemna*) Mobility in soil: Fairly mobile but rapidly degraded Persistence in soil: Quickly degraded in aerobic conditions (t/2=24 days) Bio-accumulation: Low potential

Risk Phrases

R8 – contact with combustible material may cause fire
R10 – flammable
R11 – highly flammable
R12 – extremely flammable
R50 - toxic to aquatic organisms
R51/53 - toxic to aquatic organisms, may cause log-term adverse effects in the environment

APPENDIX D

EAC SITE INVESTIGATION REPORT