WYG Ireland
part of the WYG group

Seveso II Directive Classification

For the East Tip site of the former Irish Ispat Steel Plant, Haulbowline, Cork for Department of Environment, Heritage and Local Government

November 2008

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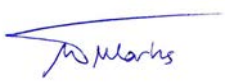
V1	21/11/08			
V2	-			
V3	-			
V4	-	Walter Marks BSc EurOSHM CMIOSH CEnv CSci CChem MRSC MIEMA	Michael Boyd BSc MSc FGS	Kevin Cleary BSc MSc FGS PGeo
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Seveso II Directive Classification

Department of Environment, Heritage and Local Government

November 2008

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APPENDICES

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Abbreviations

COMAH	Control of Major Accident Hazards Regulations
EC	European Community
HxCDD	Hexa Chloro Dibenzo Dioxin
HpCDD	Hepta Chloro Dibenzo Dioxin
HxCDF	Hexa Chloro Dibenzo Furan
HpCDF	Hepta Chloro Dibenzo Furan
HSA	Health and Safety Authority
ITEF	International Toxic Equivalence Factor
I-TEQ	International toxic equivalent
NATO	North American Treaty Organisation
CCMS	Committee on the Challenges to Modern Society
kg	kilogram
ng	nanogram
OCDD	Octa Chloro Dibenzo Dioxin
OCDF	Octa Chloro Dibenzo Furan
PCDD	Poly Chloro Dibenzo Dioxin
PCDF	Poly Chloro Dibenzo Furan
PeCDD	Penta Chloro Dibenzo Dioxin
PeCDF	Penta Chloro Dibenzo Furan
SH	Spoil Heap
t	tonne (1000kg)
TCDD	Tetra Chloro Dibenzo Dioxin
TCDF	Tetra Chloro Dibenzo Furan
TEF	Toxic Equivalence Factor

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1. Introduction

1.1. Site Description

1.1.1. Haulbowline Island is located within Cork Harbour, between Cobh to the north and Ringaskiddy to the south. It is connected to the mainland at Ringaskiddy via a bridge. This bridge connects with a small island known as Rocky Island which is currently in use as a crematorium. Spike Island is located to the south east and was connected to Haulbowline Island prior to the development of the East Tip via a causeway.

1.1.2. The occupation of Haulbowline Island is shared between the former Irish Steel/Irish Ispat site and the Irish Naval Service. The Coastal and Marine Research Centre (CMRC) which is part of University College Cork is accommodated on the Navy's property. According to Cork County Council there are currently no permanent residents living on the Island.

1.1.3. The western section of the island is owned by the Navy and the central section was the main operational area of the former steelworks. The naval dock and associated buildings are located to the east of the main steelworks site and was previously utilized by Irish Steel for the transportation of materials. East of the naval property is the East Tip which is an area of land reclaimed from the Spit Bank by infilling of processing waste from the steelworks processes.

1.1.4. The majority of buildings associated with the steel production have been demolished and cleared from the site since 2005. A number of listed buildings were retained.

1.1.5. The western portion of the Island, occupied by the naval base, consists of limestone rock outcrop, which falls to the east and the south. It is reported that the majority of the land east of the outcropping bedrock, including the area occupied by the former main steelworks site, naval docks and the East Tip have been formed by infilling, with quarry materials and on-site production wastes.

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1.2. Instruction

1.2.1 WYG carried out a site investigation of the former steelworks site at Haulbowline Island in 2005 which involved a soil and groundwater contamination and geotechnical assessment. The assessment included areas of the main steelworks site outside the buildings and the area of the East Tip where waste slag material together with other historical waste was placed from the steelwork processes.

1.2.2 As part of the recent contractor works on the East Tip area, the excavated material in the area to the east of the Naval Playing Field was stockpiled for screening purposes.

1.2.3 WYG understands that the stockpiles largely consist of slag material with potentially mill scale and other wastes from the former steelwork activities.

1.2.4 There are number of waste stockpiles on site from the excavation works.

1.2.5 To assess the contamination of the stockpiled material, WYG took samples from each stockpile.

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1.2.6 Waste characterization of the stockpiles was requested by the Health and Safety Authority (HSA) in order to determine if the content of the material contains hazardous substances which would require invocation of the requirements of the Seveso II Directive at the site (See Section 2 - Regulatory Framework).

1.2.7 This report sets out the substances within the Seveso II directives which could potentially be applicable to this site (see Section 3), further discusses arsenic (see Section 4), further discusses dioxins and furans (see Section 5), details the methodology used for surveying the stockpile (see Section 6), and the calculations used to assess against the Seveso II requirements (sections 7 and 8)

1.2.8 The conclusions are presented in section 9.

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2. Regulatory Framework

2.1. EC Seveso II Directive

2.1.1. The Seveso II Directive 96/82/EC applies to all establishments where dangerous substances are present in sufficiently large quantities to create a major-accident hazard. All Seveso classified sites must prepare policies for the prevention of major accidents.

2.1.2. Attention must be paid to safety aspects in relation to development in zones close to such industrial sites.

2.1.3. In particular the Directive lays down essential requirements for the site operator's management systems and Member State control systems.

2.1.4. The Directive places a general duty on sites using large quantities of certain specified dangerous substances to prevent major accidents and to limit the effects on the environment and the community.

2.1.5. Initially new establishments and those covered for the first time are required to notify the competent national authorities of the details listed in Article 6 of the Directive and within the timescales specified. All establishments covered by the rules must notify the authorities in the event of any significant increase or change of form of the dangerous substance or in the event of the closure of the installation.

2.1.6. The following specific duties apply when a site uses, produces or stores any of a list of named substances or categories of substances in quantities above specified thresholds:

- production of a major-accident prevention policy;
- production of a safety report;
- production of an on-site emergency plan;
- production of an off-site emergency plan (by the competent local authority);
- informing the public of safety measures and the correct behaviour to adopt in the event of an accident.

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2.2. Secondary Legislation

2.2.1. The European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006 (hereafter referred to as the Regulations) came into force in February 2006, and implements the Seveso II Directive 96/82/EC, on the control of major accident hazards involving dangerous substances.

2.2.2. The Regulations revoke and replace –

(i) the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2000 (S.I. No. 476 of 2000), and

(ii) the European Communities (Control of Major Accident Hazards Involving Dangerous Substances)(Amendment) Regulations 2003 (S.I. No. 402 of 2003).

2.2.3. The Regulations apply to establishments where dangerous substances are present in amounts equal to or exceeding the application thresholds. There is a two tier system depending on the quantities involved.

2.2.4. They implement the Seveso II Directive 96/82/EC, on the control of major accident hazards involving dangerous substances.

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2.2.5. Establishments where there is a dangerous substance at or above the level set out in column 2 of Part 1 of Schedule 1 must comply with part of these Regulations (lower tier), but where the amount is at or above the level in column 3, they must comply with additional requirements for a top tier site.

2.2.6. Operators at all sites covered by these regulations must take measures to prevent major accidents and limit their consequences to people and the environment.

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3. Substances Applicable To This Site

3.1. Schedule 1, Part 1

3.1.1. Regulation 4 of the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006 states:

"Subject to paragraph (2), these Regulations shall apply to an establishment where a dangerous substance listed in column 1 of Parts 1 or 2 of Annex 1 of the directive (which is set out in Schedule 1) is present in a quantity equal to or exceeding the quantity listed in the entry for that substance in column 2 of those parts, except that Regulations 12 to 18 shall apply to an establishment where such a dangerous substance is present in a quantity equal to or exceeding the quantity listed in the entry for that substance in column 3 of those parts"

3.1.2. WYG have reviewed the substances listed in column 1 referred to above.

3.2. Materials Excluded From Consideration

3.2.1. A number of substances have been excluded form further consideration in this report. The grounds for their exclusion are set out in the paragraphs below:

3.2.2. Only Applicable if present as a fertilizer:

- Ammonium Nitrate
- Potassium Nitrate

3.2.3. Liquid which does not occur naturally and would quickly hydrolyse in the environment:

- Bromine
- Methylisocyanate

3.2.4. Gaseous substance which would disperse:

- Chlorine
- Fluorine
- Hydrogen
- Acetylene
- Ethylene oxide
- Oxygen
- Carbonyl dichloride (phosgene)
- Arsenic trihydride (arsine)
- Phosphorus trihydride (phosphine)
- Sulphur trioxide

3.2.5. Liquefied gas which would disperse:

- Hydrogen chloride (liquefied gas)
- Liquefied extremely flammable gases (including LPG) and natural gas

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3.2.6. Not present in inhalable powder form:

- Nickel compounds (nickel monoxide, nickel dioxide, nickel sulphide, trinickel disulphide, dinickel trioxide)

3.2.7. Not present in powder form:

- 4,4-methylenebis (2-chloroaniline) and/or its salts [MBOCA]

3.2.8 Degrades to propylene glycol in water:

- Propylene oxide

3.2.9 Volatile liquid which would evaporate:

- Methanol

3.2.10 Reacts in water to form an aromatic polymer:

- Toluene Diisocyanate

3.2.11 Hydrolyses to release Hydrogen Chloride:

- Sulphur dichloride

3.2.12 Carcinogens only relevant at concentrations above 5% [None are present at this concentration]:

- 4-Aminobiphenyl and/or its salts, Benzotrichloride, Benzidine and/or salts, Bis (chloromethyl) ether, Chloromethyl methyl ether, 1,2-Dibromoethane, Diethyl sulphate, Dimethyl sulphate, Dimethylcarbamoyl chloride, 1,2-Dibromo-3-chloropropane, 1,2-Dimethylhydrazine, Dimethylnitrosamine, Hexamethylphosphoric triamide, Hydrazine, 2-Naphthylamine and/or salts, 4—Nitrodiphenyl, and 1,3 Propanesultone

  Analysis is not available for all of these carcinogens but 1,2–dibromoethane is present at <5 mg/kg (limit of detection) and 1,2-dibromo-3-chloropropane is present at <13 mg/kg (limit of detection). In order for these materials to be present at >5% they would have to exceed 50,000 mg/kg. Hence these substances are not further considered.

3.2.13 Petroleum products (the threshold for lower tier is 2500t and this report is only considering 3052t of soil hence any low concentration hydrocarbon contamination present is not relevant):

- Gasolines and naphthas
- Kerosenes (including jet fuels)
- Gas oils (including diesel fuels, home heating oils and gas oil blending streams)

3.2.14 Only applicable if concentration is above 90%:

- Formaldehyde

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3.2.15 Substance which is used for adhesive production (not known to have occurred on this site) and which is miscible with water and would have leached from the stockpiles:

- Ethyleneimine

3.2.16 Substance shown to be present at less than 2% of the qualifying quantity and thus excluded under Schedule 1, Rule 4:

- Lead alkyls

Tetra-ethyl lead, abbreviated TEL, is an organometallic compound with the formula $(CH_3CH_2)_4Pb$ or $C_8H_{20}Pb$. Once a common antiknock additive in gasoline (petrol), TEL usage was largely discontinued because of the toxicity of lead and its deleterious effect on catalytic converters.

It is unlikely that lead alkyl species are present in significant quantities on this site because leaded petrol would not have been stored on site in significant quantities.

Reviewing the speciated Total Petroleum Hydrocarbons (TPH) results for each stockpile (SH101, SH102, SH103, SH104, SH105) shows that the aliphatic C_8-C_{10} speciation giving consistent results of <0.010mg/kg (limit of detection).

Based on a total stockpile weight of 3,052,200kg, this would give a maximum aliphatic C_8-C_{10} mass present of (3,052,200kg x 0.010 mg/kg) = 30522mg = 30.522g = 0.030522kg = 0.000030522t

Converting this to tetraethyl lead equivalent by multiplying by the ratio of molecular weight of $(CH_3CH_2)_4Pb$ to $(CH_3CH_2)_4$, this gives (0.000030522t x (323.44/116.24) = 0.000084928 t

The Regulations state that the qualifying quantity for "Lead Alkyls" is 5 tonnes (lower tier).

The 2% rule therefore applies and hence the Regulations do NOT apply for Lead Alkyls.

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3.3. Materials Further Considered

3.3.1 The following materials ARE further considered in this report:

- Polychlorodibenzofurans and polychlorodibenzodioxins (including TCDD), calculated in TCDD equivalent – see Section 5.
- Arsenic pentoxide, arsenic (v) acid and or/salts – see Section 4.
- Arsenic trioxide, arsenious (III) acid and/or salts– see Section 4.

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4. Arsenic

4.1. Introduction

4.1.1 Arsenic occurs naturally in a wide range of minerals, which, together with a once widespread use of arsenic in pigments, insecticides and herbicides, represent the major sources of arsenic in the natural environment.

4.1.2 Part 1 of Schedule 1 of the Regulations lists the following substances for consideration:

- Arsenic pentoxide, arsenic (V) acid and / or salts.
- Arsenic pentoxide, arsenic (III) acid and / or salts.

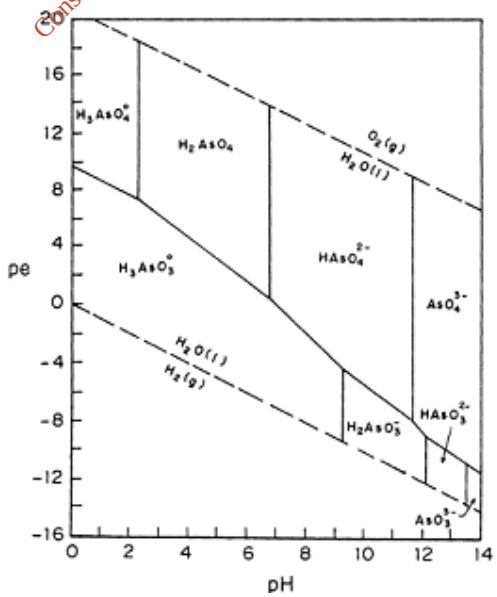
4.2. Speciation

4.2.1 The most common oxidation states for arsenic are -3 (arsenides: usually alloy-like intermetallic compounds), +3 (arsenates(III) or arsenites, and most organoarsenic compounds), and +5 (arsenates(V): the most stable inorganic arsenic oxycompounds).

4.2.2 The speciation of arsenic in environmental materials is of interest because of the differing levels of toxicity exhibited by the various species. The individual physico-chemical forms may include particulate matter and dissolved forms such as simple inorganic species, organic complexes and the element adsorbed on a variety of colloidal particles.

4.2.3 The major arsenic species found in environmental samples are arsenite As(III), arsenate As(V), arsenious acids (H_3AsO_3, $H_2AsO_3^-$, $HAsO_3^{2-}$), and arsenic acids (H_3AsO^4, $H_2AsO_4^-$, $HAsO_4^{2-}$).

4.2.4 Arsenic acid itself predominates only at extremely low pH (< 2); within a pH range of 2 to 11, it is replaced by its derivatives $H_2AsO_4^-$ and $HAsO_4^{2-}$. See figure below.



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4.2.5 The soil pH values for the stockpiles under consideration are as follows:

Stockpile	pH
SH101	9.34
SH102	9.40
SH103	9.21
SH104	9.40
SH105	9.41

4.2.6 Hence the likely speciation in the samples is $HAsO_4^{2-}$, a derivative of arsenic acid / arsenic (V).

4.2.7 The available analytical values, presented in Appendix 4, are for Total Arsenic. Speciated analysis is not available.

4.2.8 Based on the likely speciation above, we have performed the Seveso calculations for arsenic (in Section 8) by assuming that total arsenic value relates entirely to Arsenic (V).

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5. Dioxins and Furans

5.1. Polychlorinated Dibenzodioxins

5.1.1 Polychlorinated dibenzodioxins (PCDDs), or simply dioxins, are a group of halogenated organic compounds which are significant because they act as environmental pollutants. They are commonly referred to as dioxins for simplicity in scientific publications because every PCDD molecule contains a dioxin skeletal structure. Typically, the p-dioxin skeleton is at the core of a PCDD molecule, giving the molecule a dibenzo-p-dioxin ring system. Members of the PCDD family have been shown to bioaccumulate in humans and wildlife due to their lipophilic properties, and are known teratogens, mutagens, and suspected human carcinogens.

5.1.2 Dioxins occur as by-products in the manufacture of organochlorides, in the incineration of chlorine-containing substances such as PVC, in the bleaching of paper, and from natural sources such as volcanoes and forest fires.

5.1.3 The structure of dibenzo-p-dioxin comprises two benzene rings joined by two oxygen bridges. This makes the compound an aromatic diether. The name dioxin formally refers to the central dioxygenated ring, which is stabilized by the two flanking benzene rings.

5.1.4 In PCDDs, chlorine atoms are attached to this structure at any of 8 different places on the molecule, at positions 1-4 and 6-9 (See Figure 1). There are 75 different types of PCDD congeners (that is: related dioxin compounds). The toxicity of PCDDs depends on the number and positions of the chlorine atoms. Congeners that have chlorines in the 2, 3, 7, and 8 positions have been found to be significantly toxic. In fact, 7 congeners have chlorine atoms in the relevant positions which were considered toxic by the NATO Committee on the Challenges to Modern Society (NATO/CCMS) international toxic equivalent (I-TEQ) scheme.

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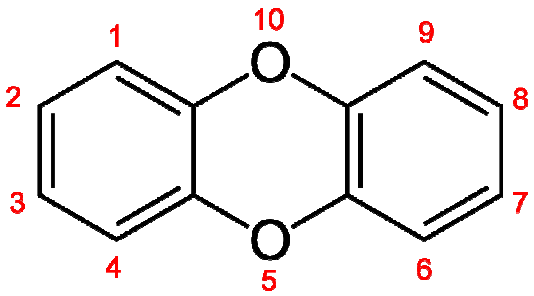
Figure 1. The skeletal formula and substituent numbering scheme of the parent compound dibenzo-p-dioxin



5.2 Polychlorinated Dibenzofurans

5.2.1 Dibenzofurans are heterocyclic organic compounds with the chemical structure shown below in Figure 2. They are aromatic compounds that have two benzene rings fused to one furan ring in the middle. All of the numbered carbon atoms have a hydrogen atom bonded to each of them (not shown in the image). Dibenzofurans are aromatic ethers having the chemical formula $C_{12}H_8O$.

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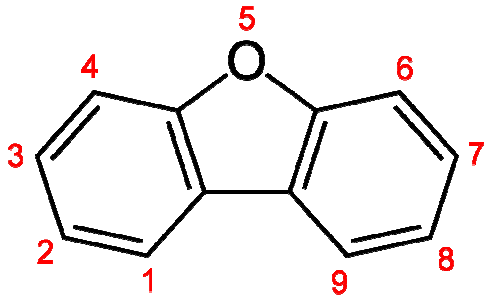
Figure 2. The skeletal formula and substituent numbering scheme of the parent compound dibenzofuran.



5.3 Toxicity

5.3.1 Dioxins are absorbed primarily through dietary intake of fat, as this is where they accumulate in animals and humans. In humans, the highly chlorinated dioxins are stored in fatty tissues and are neither readily metabolized nor excreted. The estimated elimination half-life for highly chlorinated dioxins (4-8 chlorine atoms) in humans ranges from 7.8 to 132 years.

5.3.2 The persistence of a particular dioxin congener in animals / humans is thought to be a consequence of its structure. It is believed that dioxins with fewer chlorine atoms, which thus contain hydrogen atoms on adjacent pairs of carbons, can more readily be oxidized by cytochrome P450. The oxidized dioxins can then be more readily excreted rather than stored for long time.

5.3.3 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is the most toxic of the congeners. (See Figure 3 below)

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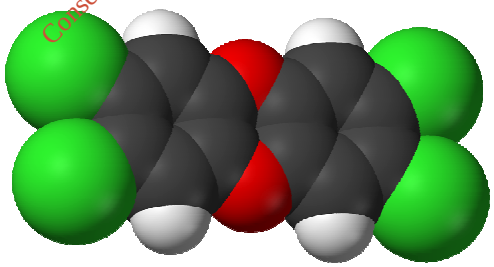
Figure 3. Space-filling model of 2,3,7,8- tetrachlorodibenzo-p-dioxin



5.3.4 Other dioxin congeners (or mixtures thereof) are given a toxicity rating from 0 to 1, where TCDD = 1. This toxicity rating is called the Toxic Equivalence Factor, or TEF. TEFs are consensus values and, because of the strong species dependence for toxicity, are listed separately for mammals, fish, and birds. TEFs for mammalian species are generally applicable to human risk calculations. The TEFs have been developed from detailed assessment of literature data to facilitate both risk assessment and regulatory control.

5.3.5 The total dioxin toxic equivalence (TEQ) value expresses the toxicity as if the mixture were pure TCDD. The TEQ approach and current TEFs have been adopted internationally as the most appropriate way to estimate the potential health risks of mixture of dioxins.

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6. Survey Methodology

6.1 Stockpile Survey

6.1.1 There are number of waste stockpiles at the East Tip on site from the excavation works, with an estimate of several hundred tonnes. In order to quantify the amount of material in the stockpiles, measurement of each stockpile on site was carried out.

6.1.2 These measurements were undertaken by a two person team using a tape measure and surveying staff.

6.1.3 The results of the stockpile survey are presented in Appendix 2.

6.1.4 The density of the material has previously been determined to be in the region of 1.8 to 2.0 tonnes per m^3.

6.1.5 The materials in each spoil heap are described in the table below:

Heap Number	Description	Sample
SH101	Dark brown to black sandy gravels and frequent cobbles. Pieces of glass, metal, plastic and wood	Soil sample
SH102	Dark brown sandy gravel and frequent cobble (more gravel and cobble than SH101). Waste steel, concrete, plastic, electrical cables, slag and plastic.	Soil sample
SH103	Same as SH102	Soil sample
SH104	Same as SH102	Soil sample
SH105	Same as SH102	Soil sample
SH/RH106 (Rubble Heap)	Grey cobble sized material. Waste wood, large amounts of metal, plastic and cables	No sample as all cobble
SH/RH107 (Rubble Heap)	Mainly grey cobble and boulder sized material – (same as SH/RH106)	No sample as all cobble
SH/RH108 (Rubble Heap)	Mainly grey cobble and boulder sized material – (same as SH/RH106)	No sample as all cobble
SH/RH109 (Rubble Heap)	Mainly grey cobble and boulder sized material – (same as SH/RH106)	No sample as all cobble

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6.2 Photographs

1780 SOIL HEAP 101

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1781 SOIL HEAP 102

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1783 SOIL HEAP 103

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1784 SOIL HEAP 104

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1785 SOIL HEAP 105

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1794-SH107 TO RIGHT & SH101 TO LEFT

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1795-SH108

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1797-SH109

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1802-RUBBLE HEAP 106

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6.3 Sample Analysis

6.3.1 To assess the contamination of the stockpiled material, composite samples were taken from each stockpile.

6.3.2 Only five samples were taken [from SH101, SH102, SH103, SH104 and SH105], as the other stockpiles consist of rubble and refractories (bricks).

6.3.3 The samples were analysed by a UKAS accredited laboratory, and the results are presented in Appendices 3 & 4.

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7.Seveso Calculations for Dioxins & Furans

7.1.1 Part 1 of Schedule 1 of the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006 ("*the Regulations*") states that the qualifying quantity for "Polychlorodibenzofurans and polychlorodibenzodioxins (including TCDD), calculated in TCDD equivalent" is 0.001 tonnes.

7.1.2 In order to determine whether the Haulbowline site exceeds the qualifying quantity, a calculation was carried out using an MS Excel spreadsheet, attached as Appendix 5. The calculation methodology is as follows:

Table 1

7.1.3 The analytical results from Alcontrol (attached as Appendix 3) were transposed into Table 1 of the spreadsheet, for each of the 5No relevant stockpiles [SH101, SH102, SH103, SH104 and SH105]. The results are given in ng/kg.

7.1.4 Any results reported as below the Limit of Detection (<2ng) are entered in the spreadsheet as 2 ng/kg. This ensures that the worst case scenario is used when determining if the qualifying quantity is exceeded.

7.1.5 Results are given in the table for Total HxCDD, Total PeCDF, Total HxCDF and Total HpCDF. These are not carried forward into the calculation as they are the sum of individual congeners whose results are carried forward. These lines are shaded grey in the spreadsheet table.

7.1.6 Results are given in a table for TCDD I- TEQ Lower Bound and TCDD I- TEQ Upper Bound. These are not carried forward into the calculation as they are the total dioxin toxic equivalence (TEQ) values (which express the toxicity as if the congeners were pure TCDD) for all of the individual congeners whose results are carried forward. These lines are shaded grey in the spreadsheet table.

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Table 2

7.1.7 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is the most toxic of the congeners. Other dioxin congeners are given a toxicity rating from 0 to 1, where TCDD = 1. This toxicity rating is called the Toxic Equivalence Factor, or TEF.

7.1.8 The TEF from Note 7 of Part 1 of the Regulations are transposed into table 2 opposite the relevant congener name in Table 1.

Table 3

7.1.9 Each cell in Table 3 shows the concentrations in ng/kg from Table 1 corrected by multiplying them by the relevant TEF from Table 2.

6.1.10 This is done because the Regulations require values to be calculated in TCDD equivalents.

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Table 4

7.1.10 The stockpile survey results (attached as Appendix 2) were transposed into Table 4 of the spreadsheet, for each of the 5No relevant stockpiles [SH101, SH102, SH103, SH104 and SH105]. The quantities are expressed in m^3.

7.1.11 Density values of 1.8 – 2 tonnes per m^3 have been typical of materials found on site. A conversion value of 2 tonnes per m^3 was used to ensure that the worst case scenario was used when determining if the qualifying quantity is exceeded.

7.1.12 The values in tonnes are converted to kg by multiplying by 1000.

Table 5

7.1.13 Each cell in Table 5 shows the quantity in ng (expressed as TCDD) in each stockpile, calculated by multiplying the corrected concentrations in ng/kg from Table 3 by the kg quantity from Table 4.

Table 6

7.1.14 Each cell in Table 6 shows the quantity in tonnes (expressed as TCDD) in each stockpile, calculated by dividing the quantities in ng from Table 5 by a conversion factor of 1×10^{15}.

Table 7

7.1.15 Each cell in Table 7 shows the total tonnage for each of the 5No relevant stockpiles [SH101, SH102, SH103, SH104 and SH105], calculated by summing the congener tonnages for each listed stockpile.

Table 8

7.1.16 Table 8 shows the TOTAL quantity in tonnes (expressed as TCDD) on each site, calculated by summing the tonnages for each stockpile in Table 7.

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7.1.17 The Regulations state that the qualifying quantity for "Polychlorodibenzofurans and polychlorodibenzodioxins (including TCDD), calculated in TCDD equivalent" is 0.001 tonnes. This is listed in Table 8 also.

7.1.18 The Regulations state at Note 4 that "This Directive shall apply if the sum

$q_1 /QU_1 + q_2 /QU_2 + q_3 /QU_3 + q_4 /QU_4 + q_5 /QU_5 + ...$is greater than or equal to 1,

where q_x = the quantity of dangerous substance x (or category of dangerous substances) falling within Parts 1 or 2 of this Annex,
and QU_X = the relevant qualifying quantity for substance or category x from column 3 of Parts 1 or 2.

Result

7.1.19 The Regulations state that the qualifying quantity for Polychlorodibenzofurans and polychlorodibenzodioxins (including TCDD), calculated in TCDD equivalent" is 0.001 tonnes.

7.1.20 The quantity of these materials on site, calculated in TCDD equivalent is 2.95305 x 10-7 tonnes.

7.1.21 The quotient calculated according to the formula in 7.1.18 above is 0.000295305. This value is less than 1; hence the Regulations do NOT apply.

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8. Seveso Calculations for Arsenic

8.1.1 Part 1 of Schedule 1 of the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006 ("*the Regulations*") states that the qualifying quantity for "Arsenic pentoxide, arsenic (V) acid and / or salts" is 1 tonne for lower tier.

8.1.2 In order to determine whether the Haulbowline site exceeds the qualifying quantity, a calculation was carried out using an MS Excel spreadsheet, attached as Appendix 6. The calculation methodology is as follows:

Table 1

8.1.3 The analytical results from Alcontrol (attached as Appendix 4) were transposed into Table 1 of the spreadsheet, for each of the 5No relevant stockpiles [SH101, SH102, SH103, SH104 and SH105]. The results are given in mg/kg.

8.1.4 The table then converts weight of Total Arsenic (V) to $HAsO_4^{2-}$ by multiplying by the ratio of the molecular weights (139.92 / 74.9216).

Table 2

8.1.5 Each cell in Table 2 shows the quantity in mg for each stockpile, calculated by multiplying the corrected concentrations in mg/kg from Table 1 by the kg quantity from Table 3.

Table 3

8.1.6 The stockpile survey results (attached as Appendix 2) were transposed into Table 3 of the spreadsheet, for each of the 5No relevant stockpiles [SH101, SH102, SH103, SH104 and SH105]. The quantities are expressed in m^3.

8.1.7 Density values of 1.8 – 2 tonnes per m^3 have been typical of materials found on site. A conversion value of 2 tonnes per m^3 was used to ensure that the worst case scenario was used when determining if the qualifying quantity is exceeded.

8.1.8 The values in tonnes are converted to kg by multiplying by 1000.

Table 4

8.1.9 Each cell in Table 4 shows the quantity in tonnes in each stockpile, calculated by dividing the quantities in mg from Table 2 by a conversion factor of 1×10^9.

Table 5

8.1.10 Table 5 shows the TOTAL quantity in tonnes (expressed as Arsenic (V)) on each site, calculated by summing the tonnages for each stockpile in Table 4.

8.1.11 The Regulations state that the qualifying quantity for "Arsenic pentoxide, arsenic (V) acid and / or salts" is 1 tonne for lower tier. This is listed in Table 5 also.

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Result

8.1.12 The Regulations state at Note 4 that "This Directive shall apply if the sum

$q_1 /QU_1 + q_2 /QU_2 + q_3 /QU_3 + q_4 /QU_4 + q_5 /QU_5 + ...$ is greater than or equal to 1,

where q_x = the quantity of dangerous substance x (or category of dangerous substances) falling within Parts 1 or 2 of this Annex, and QU_X = the relevant qualifying quantity for substance or category x from column 3 of Parts 1 or 2.

8.1.13 The quantity of these materials on site, calculated as Arsenic (V) is 0.238620001 tonnes.

8.1.14 The quotient calculated according to the formula above is 0.238620001. This value is less than 1; hence the Regulations do NOT apply.

9. Conclusion

9.1 The overall quotient for the site is calculated by adding that for dioxins / furans to that for arsenic, both Part 1 Named Substances = (0.238620001 + 0.000295305) = 0.238915306.

9.2 The Haulbowline site does NOT require regulation under the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006.

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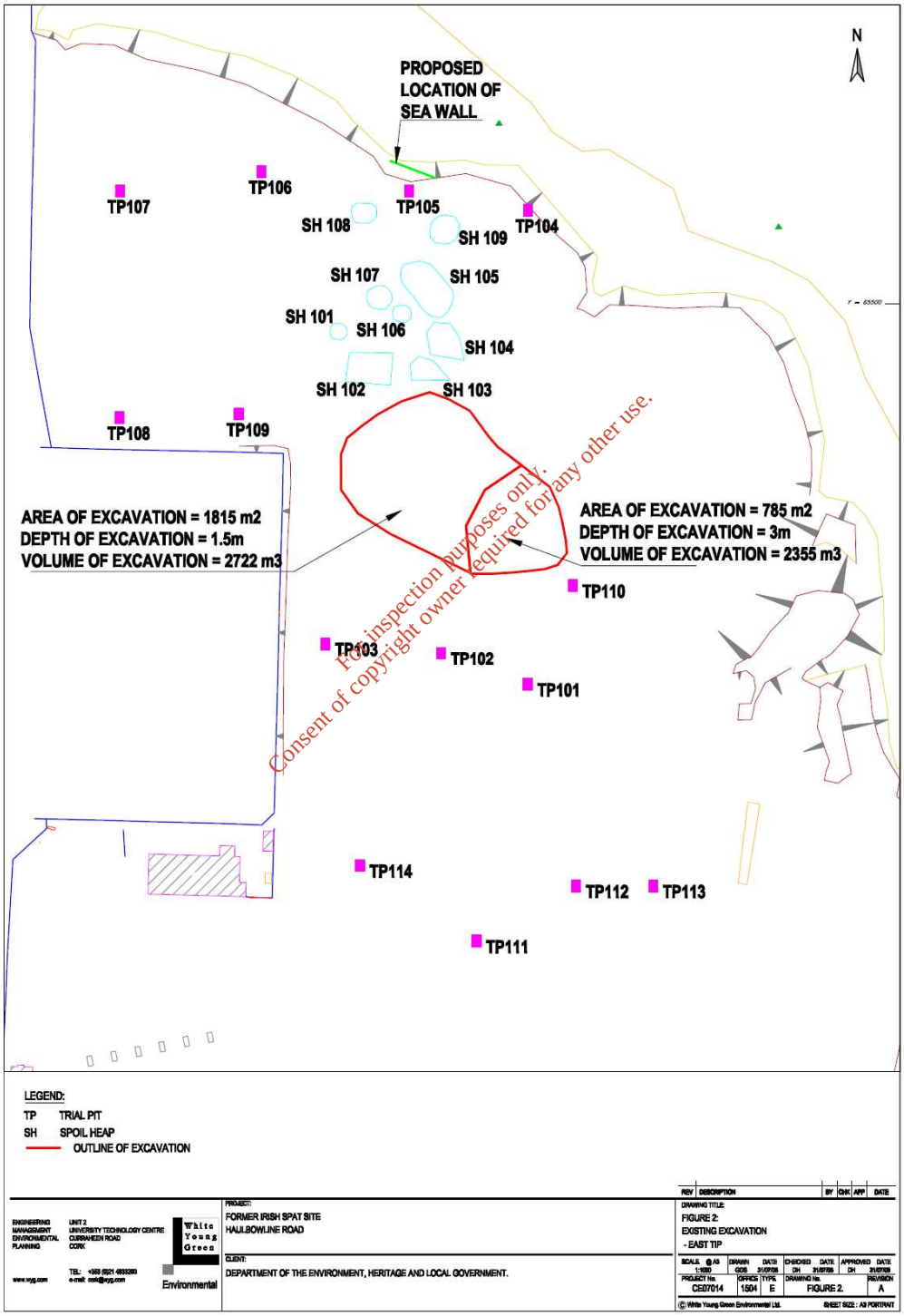
APPENDIX 1
SPOILHEAP LOCATION DIAGRAM



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APPENDIX 2
STOCKPILE SURVEY RESULTS

Stock Pile No.	Dimensions (metres) (Length x width x height)	cubic metres	Rough Shape
SH101	4.9 x 5.2 x 1.9	48.4	cone
SH102	14 x 10 x 2.1	294.0	rectangle
SH103	6.0 x 13.3 x 2.6	207.5	cube
SH014	13 x 13 x 1.8	304.2	cube
SH105	20 x 10.5 x 3.2	672.0	rectangle
SH106	5.5 x 6 x 1.5	49.5	cone
SH107	7.5 x 7 x 1.5	78.8	cone
SH108	8.0 x 6.0 x 1.95	93.6	cone
SH109	9.5 x 9 x 1.9	162.5	cone
Total		1910	

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APPENDIX 3
DIOXIN AND FURAN RESULTS TABLE – ALCONTROL

Sample Identity	LoD/Units	TSV comm/ind	KTK Acceptance Values	Murphys Acceptance Values	SH101	SH102	SH103	SH104	SH105
Sample Type					SOIL	SOIL	SOIL	SOIL	SOIL
Sampled Date					09.07.08	09.07.08	09.07.08	09.07.08	09.07.08
Sample Received Date					10.07.08	10.07.08	10.07.08	10.07.08	10.07.08
Sample Number(s)					S0009	S0010	S0011	S0012	S0013
	ng/kg	ng/kg	ng/kg	ng/kg	ng/kg	ng/kg	ng/kg	ng/kg	ng/kg
2,3,7,8 TCDD	<2	1300	-	-	<2	<2	<2	<2	<2
1,2,3,7,8 PeCDD	<2	-	-	-	7.4	17.0	28.0	29.0	8.4
1,2,3,4,7,8 HxCDD	<2	-	-	-	6.4	16	12	27	8.9
1,2,3,6,7,8 HxCDD	<2	-	-	-	31	54.0	56.0	260.0	40
1,2,3,7,8,9 HxCDD	<2	-	-	-	22	31.0	32.0	87.0	31.0
HxCDD	<2	-	-	-	59.4	101	100	374	79.9
1,2,3,4,6,7,8 HpCDD	<2	-	-	-	350.0	360	470	6700	250
OCDD	<2	-	-	-	1200	1100	1400	51000	620
2,3,7,8, TCDF	<2	-	-	-	31	54	54.0	64	64
1,2,3,7,8 PeCDF	<2	-	-	-	19	43	32.0	41.0	32
2,3,4,7,8 PeCDF	<2	-	-	-	25	53.0	43.0	63	38
PeCDF	<2	-	-	-	44	96	75	104	70
1,2,3,4,7,8 HxCDF	<2	-	-	-	25	47	35.0	62.0	32
1,2,3,6,7,8 HxCDF	<2	-	-	-	23	48.0	25.0	54.0	20.0
1,2,3,7,8,9 HxCDF	<2	-	-	-	3.1	4.2	<2	2.4	<2
2,3,4,6,7,8 HxCDF	<2	-	-	-	21	57	35	91.0	28.0
HxCDF	<2	-	-	-	72.1	156.2	95	209.4	80
1,2,3,4,6,7,8 HpCDF	<2	-	-	-	89	180	120	420	70
1,2,3,4,7,8,9 HpCDF	<2	-	-	-	<2	22.0	15	29.0	7.7
HpCDF	<2	-	-	-	89	202	135	449	77.7
OCDF	<2	-	-	-	120	160	71	260	43
TCDD I-TEQ Lower Bound	<2	-	-	-	39	75	69	240	51
TCDD I-TEQ Upper Bound	<2	-	-	-	41.0	77	71	240	53

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Legend:

ng/kg = nanograms per kilogram

WYG TSV: Threshold Screening Values (Issue 7c)

WYG TSVs for commercial/industrial end use were used

KTK Acceptance Values = Acceptance values for KTK landfill. EPA licensed facility No. 81-2

Murphy's Acceptance Values = Acceptance values for Murphy's landfill. EPA licensed facility No. 129-1

- indicates no relevant comparison value available

Results are Underlined where they exceed the WYG TSV

Results are in Bold where they exceed the KTK Landfill acceptance criteria

Results are shaded where they exceed the Murphy's Landfill acceptance criteria

** Laboratory limit of detection is above the Murphys acceptance criteria*

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APPENDIX 4
ARSENIC RESULTS TABLE – ALCONTROL

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland
Table Of Results

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Ref Number: 08-B04139/01 **Sample Type: SOIL**
Client: White Young Green (Cork) Ltd Location:
Date of Receipt: 09/07/2008 Client Contact: Tom Mc Carthy
(of first sample) Client Ref: CE07014/TMC/1549

	Detection Method	HPLC	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP
	Method Detection Limit	<0.01mg/l	<1mg/kg	<1mg/kg	<0.5mg/kg	<1mg/kg	<0.5mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg	<1mg/kg
UKAS Accredited [Testing Laboratory] No. 1291			✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
ALcontrol Reference	Sample Identity	Other ID	Total Xylenols in NRA Leachate	Aluminium	Antimony	Arsenic Low Level	Barium	Cadmium Low Level	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Molybdenum
			mg/l	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
08-B04139-S0009	SH 101	UNKNOWN	<0.01	7231	48	53.0	468	9.0	43620	1131	41	1344	>32000	975	18970	7936	86
08-B04139-S0010	SH 102	UNKNOWN	-	8447	58	44.0	575	11.0	50900	1153	35	1227	>32000	1277	26270	9257	75
08-B04139-S0011	SH 103	UNKNOWN	<0.01	8814	48	50.0	398	9.0	49710	1178	44	1309	>32000	1176	19070	8793	87
08-B04139-S0012	SH 104	UNKNOWN	-	8933	47	41.0	340	19.0	52580	1394	33	1081	>32000	1034	24770	10540	69
08-B04139-S0013	SH 105	UNKNOWN	<0.01	8828	47	38.0	454	9.0	50100	1250	36	1293	>32000	989	22420	9599	73

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Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL. **NDP** = NO DETERMINATION POSSIBLE

Checked By : Norah O'Connor

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APPENDIX 5 –
SEVESO APPLICABILITY CALCULATION – DIOXINS and FURANS

Seveso II Calculation - Dioxins and Furans

Table 1

	LABORATORY TEST RESULTS FROM APPENDIX 3				
	SH101	SH102	SH103	SH104	SH105
Dioxins	ng/kg	ng/kg	ng/kg	ng/kg	ng/kg
2, 3, 7, 8 TCDD	2	2	2	2	2
1, 2, 3, 7, 8 PeCDD	7.4	17.0	28.0	29.0	8.4
1, 2, 3, 4, 7, 8 HxCDD	6.4	16	12	27	8.9
1, 2, 3, 6, 7, 8 HxCDD	31	54.0	56.0	260.0	40
1, 2, 3, 7, 8, 9 HxCDD	22	31.0	32.0	87.0	31.0
HxCDD	59.4	101	100	374	79.9
1, 2, 3, 4, 6, 7, 8 HpCDD	350.0	360	470	6700	250
OCDD	1200	1100	1400	51000	620
2, 3, 7, 8 TCDF	31	54	54.0	64	64
1, 2, 3, 7, 8 PeCDF	19	43	32.0	41.0	32
2, 3, 4, 7, 8 PeCDF	25	53.0	43.0	63	38
PeCDF	44	96	75	104	70
1, 2, 3, 4, 7, 8 HxCDF	25	47	35.0	62	32
1, 2, 3, 6, 7, 8 HxCDF	23	48.0	25.0	54.0	20.0
1, 2, 3, 7, 8, 9 HxCDF	3.1	4.2	2	2.4	2
2, 3, 4, 6, 7, 8 HxCDF	21	57	35	91.0	28.0
HxCDF	72.1	156.2	95	209.4	80
1, 2, 3, 4, 6, 7, 8 HpCDF	89	180	120	420	70
1, 2, 3, 4, 7, 8, 9 HpCDF	2	22.0	15	29.0	7.7
HpCDF	89	202	135	449	77.7
OCDF	120	160	71	260	43
TCDD I- TEQ Lower Bound	39	75	69	240	51
TCDD I- TEQ Upper Bound	41.0	77	71	240	53

Table 2

Part I, Note 7

ITEF FACTOR
1
0.5
0.1
0.1
0.1
0.01
0.001
0.1
0.05
0.5
0.1
0.1
0.1
0.1
0.01
0.01
0.001

Table 3

RESULTS FROM TABLE 1 CORRECTED BY ITEF FACTOR				
SH101	SH102	SH103	SH104	SH105
ng/kg	ng/kg	ng/kg	ng/kg	ng/kg
2	2	2	2	2
3.7	8.5	14	14.5	4.2
0.64	1.6	1.2	2.7	0.89
3.1	5.4	5.6	26	4
2.2	3.1	3.2	8.7	3.1
3.5	3.6	4.7	67	2.5
1.2	1.1	1.4	51	0.62
3.1	5.4	5.4	6.4	6.4
0.95	2.15	1.6	2.05	1.6
12.5	26.5	21.5	31.5	19
2.5	4.7	3.5	6.2	3.2
2.3	4.8	2.5	5.4	2
0.31	0.42	0.2	0.24	0.2
2.1	5.7	3.5	9.1	2.8
0.89	1.8	1.2	4.2	0.7
0.02	0.22	0.15	0.29	0.077
0.12	0.16	0.071	0.26	0.043

Table 5

MASS DIOXIN PRESENT (ng) BASED ON SOIL QUANTITIES (TABLE 4)				
SH101	SH102	SH103	SH104	SH105
ng	ng	ng	ng	ng
193600	1176000	830000	1216800	2688000
358160	4998000	5810000	8821800	5644800
61952	940800	498000	1642680	1196160
300080	3175200	2324000	15818400	5376000
212960	1822800	1328000	5293080	4166400
338800	2116800	1950500	40762800	3360000
116160	646800	581000	31028400	833280
300080	3175200	2241000	3893760	8601600
91960	1264200	664000	1247220	2150400
1210000	15582000	8922500	19164600	25536000
242000	2763600	1452500	3772080	4300800
222640	2822400	1037500	3285360	2688000
30008	246960	83000	146016	268800
28328	3351600	1452500	5536440	3763200
86152	1058400	498000	2555280	940800
1936	129360	62250	176436	103488
11616	94080	29465	158184	57792

Table 6

MASS DIOXIN PRESENT (t) - Converted from ng in Table 5				
SH101	SH102	SH103	SH104	SH105
t	t	t	t	t
1.936E-10	1.176E-09	8.3E-10	1.2168E-09	2.688E-09
3.5816E-10	4.998E-09	5.81E-09	8.8218E-09	5.6448E-09
6.1952E-11	9.408E-10	4.98E-10	1.64268E-09	1.19616E-09
3.0008E-10	3.1752E-09	2.324E-09	1.58184E-08	5.376E-09
2.1296E-10	1.8228E-09	1.328E-09	5.29308E-09	4.1664E-09
3.388E-10	2.1168E-09	1.9505E-09	4.07628E-08	3.36E-09
1.1616E-10	6.468E-10	5.81E-10	3.10284E-08	8.3328E-10
3.0008E-10	3.1752E-09	2.241E-09	3.89376E-09	8.6016E-09
9.196E-11	1.2642E-09	6.64E-10	1.24722E-09	2.1504E-09
1.21E-09	1.5582E-08	8.9225E-09	1.91646E-08	2.5536E-08
2.42E-10	2.7636E-09	1.4525E-09	3.77208E-09	4.3008E-09
2.2264E-10	2.8224E-09	1.0375E-09	3.28536E-09	2.688E-09
3.0008E-11	2.4696E-10	8.3E-11	1.46016E-10	2.688E-10
2.0328E-10	3.3516E-09	1.4525E-09	5.53644E-09	3.7632E-09
8.6152E-11	1.0584E-09	4.98E-10	2.55528E-09	9.408E-10
1.936E-12	1.2936E-10	6.225E-11	1.76436E-10	1.03488E-10
1.1616E-11	9.408E-11	2.9465E-11	1.58184E-10	5.7792E-11

Key

	Title Field
	Subtotal values not further included in calculations
Text in red	indicates values used are at Limit of Detection

Table 4

	SH101	SH102	SH103	SH104	SH105
Stockpile (m3)	48.4	294	207.5	304.2	672
Conversion (t/m3)	2	2	2	2	2
Stockpile (t)	96.8	588	415	608.4	1344
Stockpile (kg)	96800	588000	415000	608400	1344000

Table 7
Tonnages of Dioxins / Furans on site

SH101	SH102	SH103	SH104	SH105
t	t	t	t	t
3.98138E-09	4.53642E-08	2.97642E-08	1.44519E-07	7.16755E-08

Table 8
Total tonnages of Dioxins / Furans on site

Total	Seveso Limit	Quotient
t	t	
2.95305E-07	0.001	0.000295305

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APPENDIX 6 – SEVESO APPLICABILITY CALCULATION – ARSENIC

Seveso II Calculation - Arsenic

Table 1

	LABORATORY TEST RESULTS FROM APPENDIX 3				
Compounds	SH101	SH102	SH103	SH104	SH105
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Total Arsenic	53	44	50	41	38
Arsenic as HAsO4 (2–)	98.98238	82.17405	93.3796	76.57128	70.9685

Table 2

MASS SUBSTANCES PRESENT (mg) BASED ON SOIL QUANTITIES (TABLE 3)					
SH101	SH102	SH103	SH104	SH105	
mg	mg	mg	mg	mg	
9,581,494.50	48,318,342.77	38,752,536.04	46,585,964.34	95,381,663.64	

Table 4

MASS SUBSTANCES PRESENT (t) - Converted from mg in Table 2				
SH101	SH102	SH103	SH104	SH105
t	t	t	t	t
0.009581495	0.048318343	0.038752536	0.046585964	0.095381664

Key

Title Field

Table 3

	SH101	SH102	SH103	SH104	SH105
Stockpile (m3)	**48.4**	**294**	**207.5**	**304.2**	**672**
Conversion (t/m3)	2	2	2	2	2
Stockpile (t)	96.8	588	415	608.4	1344
Stockpile (kg)	**96800**	**588000**	**415000**	**608400**	**1344000**

Table 5
Total tonnages of Arsenic (V) on site

Total	Seveso Limit	Quotient
t	t	
0.238620001	1	0.238620001

SEVESO DOES NOT APPLY

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