Royal HaskoningDHV
Enhancing Society Together

Appendix 3.1
Waste Management
YPP Harbour facilities

[Blank Page]

Document title: Appendix 3.1: Waste Management
Status: Final (Rev 1)
Date: March 2015
Project number: 9Y0989
Client: York Potash Ltd
Client contact: James Barrie

Drafted by: Gary Bower
Checked by: Matt Simpson
Date / initials check: 23/03/2015 MS
Approved by: Sian John
Date / initials approval: 23/03/2015 SAJ

[Blank Page]

CONTENTS

Tables

Figures

1 INTRODUCTION

1.1.1 This Appendix to **Chapter 3** of the Environmental Statement (ES) describes the proposals for the management of wastes that are expected to be generated during the construction, operation and decommissioning phases of the proposed scheme.

2 LEGISLATION AND POLICY

2.1 National policy

Government Waste Strategy 2007

2.1.1 The Waste Strategy for England 2007 provided a vision for sustainable waste management. The Strategy set out a range of new policies, programmes and measures, including an indicative target for the reduction of commercial and industrial waste going to landfill by at least 20% by 2010 compared to 2004. The Government further proposed, in conjunction with the construction industry, a target to halve the amount of construction, demolition and excavation wastes going to landfill by 2012 as a result of waste reduction, re-use and recycling.

2.1.2 In October 2009, The Department for Environment Food and Rural Affairs (Defra) published the Waste Strategy Annual Progress Report 2008/09. This identified the progress that had been made against the 2007 Waste Strategy.

Government review of Waste Policy in England, 2011

2.1.3 Defra conducted a review of the existing national waste policy in 2011 to set a direction towards a 'Zero Waste Economy'. This included promising increased focus on business waste, from the present trend of setting policies for household waste (which at the time represented only 9% of the overall arisings, compared to 24% for commercial & industrial (C&I) waste).

2.1.4 In 2009, 47.9 million tonnes (Mt) of waste were generated by businesses. The industrial sector accounted for 24.1Mt and the commercial sector 23.8Mt. Estimates show that 52% of C&I waste was recycled or re-used and 24% was sent to landfill.

2.1.5 To improve the service to Business while delivering environmental benefits and supporting growth, Defra stated that they would reduce the burden of regulation and enforcement on legitimate business, but target those who persistently break the law.

National Planning Policy for Waste

2.1.6 The Government recently published the national waste planning policy for England as a replacement of Planning Policy Statement 10: Planning for Sustainable Waste Management (PPS 10) 2011. The updated policy maintains the core principles of the 'plan led' approach, with a continued focus of moving waste up the waste hierarchy. It requires local planning authorities to have regard to its policies

when discharging their responsibilities to the extent that they are appropriate to waste management. The document sets out detailed waste planning policies to facilitate a more sustainable and efficient approach to resource use and management, for example by ensuring the design and layout of new residential and commercial development and other infrastructure complements sustainable waste management, including the provision of appropriate storage and segregation facilities to facilitate high quality collections of waste.

National Waste Management Plan for England 2013

2.1.7 Defra published the National Waste Management Plan for England in December 2013. The Plan identifies the measures to be taken to ensure that by 2020 at least 70% by weight of construction and demolition waste is subjected to material recovery.

BS5906:2005 - The British Standard on Waste Management in Buildings

2.1.8 BS5906 is a code of practice for methods of storage, collection and segregation for recycling and recovery, and on-site treatment of waste. BS5906 applies to new non-residential buildings, including offices.

2.2 Regional and local planning policy

Joint Minerals and Waste Development Plan Documents for the Tees Valley

2.2.1 The Tees Valley Joint Strategy Unit (JSU) is made up of the five boroughs of the Tees Valley region – Darlington, Hartlepool, Middlesbrough, Stockton and Redcar & Cleveland. The JSU is responsible for the Joint Minerals and Waste Development Plan Documents, which consist of:

1. The Core Strategy.
2. The Policies and Sites document.

2.2.2 The core strategy was adopted in September 2011. It covers the period 2011 to 2026 and reflects recent changes to national, regional and local policies, legislation and targets; in particular the development of the National Waste Strategy 2007 and, at its heart, the waste hierarchy.

Relevant strategic objectives

- To support the implementation of the Tees Valley Joint Municipal Waste Management Strategy, in particular in seeking to minimise waste production.
- To promote the re-use, recycling and recovery of value from waste.
- To promote the management of waste close to its point of production whilst recognising the existing role and future potential of the Tees Valley in specialist waste management.

Policy MWC6: Waste Strategy

2.2.3 The sustainable management of waste arisings in the Tees Valley will be delivered through (amongst others):

- *"making provision for sufficient annual waste management capacity, including -*
  - *to increase the recovery of value from commercial and industrial waste from the Tees Valley to 73% from 2016;*
- *promoting facilities and development that drives waste management up the waste hierarchy; and,*
- *safeguarding the necessary infrastructure to enable the sustainable transport of waste, in particular the use of the existing rail and port facilities in the Tees Valley*."

Policy MWP1: Waste Audits

2.2.4 A waste audit will be required for all major development proposals. The audit should identify the amount and type of waste which is expected to be produced by the development, both during the construction phase and once it is in use. The audit should set out how this waste will be minimised and where it will be managed, in order to meet the strategic objective of driving waste management up the waste hierarchy.

2.2.5 The requirements of the audit are met within this Appendix.

2.2.6 Waste audits should consider the following management options in their recommendations:

"*b) Retail, Employment and Industrial Development*

Sufficient space should be provided, for either individual organisations or groups of organisations located close together, to separate and store their waste so it is ready for collection. For proposals involving groups of buildings or developments, such as industrial estates, business parks or retail parks, consideration should also be given to on-site waste processing or treatment facilities of a suitable scale. Appropriate access should be provided for the collection of materials."

Redcar & Cleveland's Sustainable Environment Strategy 2011 – 2016

2.2.7 This document is set out to be a package of policies and actions, developed by the Council and its partners, to raise awareness, change behaviour and deliver environmental improvement across the Borough, via theme's targeted at improving sustainability.

2.2.8 Theme: 'Resource Use Priority 11: Continuous improvement in waste management practices' covers waste management according to two specific objectives:

- Objective 66: To increase recycling and minimise waste, while maintaining service quality.
- Objective 63: To minimise the borough's impact on climate change and the impact of climate change on the borough Objective 66.

2.3 Relevant waste legislation

Waste Framework Directive

2.3.1 The revised Waste Framework Directive (2008/98/EC) (rWFD) consolidates a number of separate waste Directives and amendments. It establishes the basis for the management of wastes across the EU. It defines certain terms, such as “waste”, “recovery” and “disposal”, to ensure that a uniform approach is taken across the EU.

Duty of Care

2.3.2 The waste duty of care is a legal requirement implemented by Section 34 of the Environmental Protection Act 1990, to ensure that producers and holders handle their waste safely and in compliance with the appropriate regulations. One of the fundamental aspects of the duty of care requires the holder of waste to make sure that anyone else dealing with their waste has the necessary authorisation to do so. If the holder does not do this and their waste is subsequently found to have been illegally disposed, the holder could be held responsible and may face prosecution.

2.3.3 The duty of care provisions are provided in the Waste (England & Wales) Regulations 2011 SI 2011 No. 988).

The Waste Hierarchy

2.3.4 The Waste (England and Wales) Regulations 2011 SI 2011 No. 988 implement the rWFD in England and Wales. The waste hierarchy is set out at Article 4 of the rWFD. The waste hierarchy requires a demonstration by the producer/holder of a waste that the priorities identified in **Table 2-1** have been considered in order to determine the most suitable waste management option for all waste arisings.

Table 2-1 The waste hierarchy

Waste Hierarchy	Relevant activity
Prevention	Using less material in design and manufacture, keeping products for longer, re-use, using less hazardous materials
Preparing for re-use	The waste is capable of being recycled by existing local or regional waste management facilities without requiring adaptation
Recycling	Turning waste into a new substance or product, includes composting if it meets quality protocols
Other recovery	Includes anaerobic digestion, incineration with energy recovery, gasification and pyrolysis which produce energy (fuels, heat and power) and materials from waste, some backfilling
Disposal	Landfill and incineration without energy recovery

Source: reproduced from Defra website: https://www.gov.uk/waste-legislation-and-regulations

2.3.5 It is a legal requirement for waste producers/holders to follow the waste hierarchy when making decisions about waste management options. Waste holders have to choose the highest possible hierarchical option for their wastes. Lower hierarchical options cannot be justified by cost alone. They require environmental justification over available higher options, for example the location of a site may justify sending waste to a lower option (e.g. local landfill), rather than sending it hundreds of miles to the nearest facility that could provide a higher option.

Hazardous Waste

2.3.6 The Hazardous Waste Regulations (HWR) provide the rules for assessing if a waste is hazardous or not. As part of the assessment of waste, the HWR refer to the List of Wastes (which is often referred to as the European Waste Catalogue (EWC)) for the relevant thresholds for some of the hazardous properties; and to assign the formal description and code for the waste. The regulatory framework to do this is contained in:

- Hazardous Waste (England and Wales) Regulations 2005 SI 894;
- Hazardous Waste (England and Wales) (Amendment) Regulations 2009 SI 507;
- List of Wastes (England) Regulations 2005 SI 895; and,
- List of Wastes (England) (Amendment) Regulations 2005 SI 1673.

2.3.7 Detailed technical guidance on the hazardous waste assessment process is provided by WM2 Hazardous Waste: Interpretation of the definition and classification of hazardous waste (3rd Edition, August 2013). This document is jointly approved by all of the UK environmental regulators. It provides thresholds and criteria for assessing each of the 15 hazardous properties.

3 EXISTING ENVIRONMENT

3.1 Introduction

3.1.1 The environmental baseline has been informed by data collated for a desk-based Preliminary Risk Assessment (PRA), third party reports provided as well as data collected during an initial Phase 2 intrusive site investigation undertaken by Dunelm (Dunelm, 2014). The PRA is provided in **Appendix 6-3** to **ES Chapter 6 Hydrology, Hydrogeology and Land Quality**.

3.1.2 The site is located adjacent to the Bran Sands landfill and associated lagoon. The site is predominantly flat and comprises a utilities corridor south of the landfill and orientated south-east to north-west, and an embankment west of the lagoon and orientated north to south. Access tracks are present adjacent to the utilities corridor and along the embankment and comprise crushed stone (Dunelm, 2014). Beyond the access tracks, the majority of the site is vegetated with grass.

3.1.3 The proposed scheme footprint is predominately reclaimed land. Large volumes of Made Ground have historically been used to raise a significant portion of the scheme footprint and may represent a source of contamination. Given the industrial nature of the area, there may also be residual contamination associated with historical activities. The potential contamination sources in the Made Ground from a

land quality perspective are discussed in **ES Chapter 6 Hydrology, Hydrogeology and Land Quality**, **Section 6.4**.

3.2 Bran Sands Landfill

3.2.1 Environment Agency mapping indicates that the proposed scheme is to be located partially within the boundary of the currently permitted Bran Sands landfill.

3.2.2 The Waste Management Licence (reference EAWML60092) permitted the Bran Sands landfill site to accept controlled waste as defined by Section 75 of the Environmental Protection Act 1990 (as amended), including inert waste, general and biodegradable waste, metals, contaminated general wastes, asbestos and mineral wastes from thermal processes.

3.2.3 Available information indicates that wastes have been deposited at the site since at least the 1970s, although anecdotally landfilling is known to have been undertaken from the 1940/50s. It is understood the landfill has been a co-disposal landfill, initially being used by ICI for disposal of process waste from the chemical industry. Records indicate waste deposits included drums, tar actactic, terepthalic acid, slag, dry factory refuse, oil, ash, mercury contaminated spoil, phenol contaminated wastes and oily liquids (ranging from 2% to 100% oil). More recent deposits include metals and discarded scrap composite equipment, contaminated general wastes, asbestos waste, mineral wastes and residues from thermal processes. No agro-chemicals or pharmaceutical industry wastes were deposited at the site. Liquid wastes were not disposed of after 1988 and in the 1990s the oil lagoons/ cells were dewatered and stabilised with fly ash. The thickness of the waste deposits is reported to be more than 10m in some locations. It is understood that only part of the landfill is lined and that the base of the waste deposits may sit directly on the underlying estuarine deposits.

3.2.4 Waste is no longer deposited within the Bran Sands landfill and the landfill has been capped with a composite capping system and is the subject of a closure plan as agreed with the Environment Agency. Capping was completed in April 2007, with restoration completed in 2008. Data suggests that the side slopes of the Phase 2 area comprises a 1.0m thick clay cap. The remainder of the Phase 2 area was capped with a 300mm thick clay layer, overlain by a high-density polythene geomembrane, overlain by a protection geotextile which was overlain by 1.0m of subsoil and topsoil. A surface water drainage system is in place to prevent excessive infiltration and damage to the capping system.

3.2.5 None of the activities associated with the proposed scheme would disturb any of the tipped waste in the Bran Sands landfill.

3.2.6 Bran Sands lagoon is located within the permit boundary of the Bran Sands landfill. There is hydraulic connectivity between Bran Sands lagoon and the Tees estuary via a pipe running through the embankment. The lagoon is a habitat for waterbirds.

3.3 Local waste management facilities

3.3.1 There are more than 150 waste management facilities within 10km of the proposed scheme catering for different waste types at different points in the waste hierarchy. Therefore, the search for specific local facilities that may be able to receive waste from the proposed scheme was narrowed to within 5km of the site, based on the nearest valid postcode to the site (TS6 7RU); and that the operating environmental permit has not been surrendered. **Table 3-1** identifies the waste management facilities that are within 5 km.

Table 3-1 Local waste management facilities

Operator	Address	Distance	Type of waste accepted
MGT Teesside Limited	Tees Renewable Energy Plant, Tees Dock, Cleveland	0.5 Km	Biomass Power station
Hall Construction Services Ltd	Hall Construction Teesport Landfill, Off Teesport Road, Teesdock, Nr Grangetown, Middlesbrough, Cleveland	0.6 Km	Dredging site – facility permitted to accept site won dredgings
Northumbrian Water Ltd	Waste Treatment Centre, Bran Sands, Redcar, Cleveland	1.0 Km	Biological waste treatment facility
ICI Chemicals & Polymers Ltd	Land/ Premises At, Bran Sands, Redcar, Cleveland	1.3 Km	In-house hazardous waste Landfill
Green North East Trading Bidco Limited	Teesport No3 Landfill, Grangetown, MIDDLESBROUGH, Cleveland	1.6 Km	Non-hazardous waste treatment & preparation of refuse derived fuel
Cleansing Service Group Ltd	Wilton Waste Treatment Plant, Boundary Road West, Wilton International, Cleveland	1.8 Km	Liquid and hazardous waste treatment
North Tees Waste Management Limited	Teesport No3 Landfill, Grangetown, MIDDLESBROUGH, Cleveland	2.0 Km	Hazardous waste Landfill
Polymer Industries (UK) Ltd	Polymer Industries, Polythene Road, Wilton International, Redcar, Cleveland	2.1 Km	Non–hazardous physical treatment facility

Operator	Address	Distance	Type of waste accepted
North Tees Waste Management Ltd	Teesport No 2, Teesport	2.1 Km	Non-hazardous waste Landfill
Corus Construction & Industrial (British Steel Plc)	Teesside Division, Steel House, Redcar, Cleveland	2.1 Km	Non-hazardous physical treatment facility (non-operational)
Biffa Polymers Ltd	Plastics Road, Wilton Ind. Est, Redcar, Cleveland	2.3 Km	Materials recycling facility - Inert & Non Hazardous materials
Seal Sands Storage Limited	Seal Sands Road, Seal Sands, Middlesbrough, Cleveland	2.3 Km	In-house waste storage facility
UK Wood Recycling Ltd	Wilton International, Former Freightliner Site, Trun, Middlesbrough, Cleveland	2.3 Km	Wood recycling
Fine Environmental Services Ltd	SEAL SANDS, MIDDLESBROUGH	2.5 Km	Thermal oxidation of hazardous liquid waste
Hadfield Wood Recyclers Limited	Wilton International, Off Trunk Road, Middlesbrough, Teesside	2.6 Km	Wood recycling
Redcar & Cleveland Borough Council	Warrenby Depot, Tod Point Road, Redcar, Cleveland	2.8 Km	Council depot – specific waste types unknown
Alpha Car Imports	Land/ Premises At, Tod Point Road, Warrenby, Redcar, Cleveland	2.9 Km	Metal recycling and end of life vehicle facility
Harpers Environmental Services Ltd	Holden Close Waste Management Facility, Holden Close, Bolckow Ind Est, Middlesbrough, Cleveland	2.9 Km	Hazardous waste treatment facility
Scott Bros Recycling Limited	Land/premises At, Holden Close, Bolckow Ind Est, Middlesbrough, Cleveland	2.9 Km	Household, industrial & commercial transfer station

Operator	Address	Distance	Type of waste accepted
Cleansing Service Group Limited	UK Resource Management Ltd, Holden Close, Bolckow Industrial Estate, Grangetown	2.9 Km	Liquid and hazardous waste treatment
Anglian Water Services Ltd	Hartlepool Water, North Tees Site, Seaton Road, Middlesbrough, Cleveland	3.1 Km	Waste water treatment
1st Choice Skip Hire North East Limited	1st Choice Skip Hire North East Ltd, Tod Point Road, Redcar, Cleveland	3.1 Km	Household, commercial and industrial waste transfer facility
Andrew Morton	Smiths Dock Road, South Bank, Middlesbrough, Cleveland	3.2 Km	End of life vehicle facility
Ward Recycling Ltd	Container Sorting Line, Puddlers Road, South Tees Ind Est, Middlesbrough, Cleveland	3.2 Km	Hazardous waste physical treatment facility, metals
C & L Autos	C & L Autos, Smith Dock Road, Middlesbrough, Cleveland	3.3 Km	End of life vehicle facility
L & C Skip Hire Ltd	L & C Skip Hire Ltd, Smith Dock Road, Middlesbrough, Cleveland	3.3 Km	Household, commercial and industrial waste transfer facility
North Tees Waste Management Limited	Reclamation Ponds Site, North Tees Access Road, Port Clarence, Middlesbrough, Cleveland	3.4 Km	Deposit of sediment for recovery - Physical treatment facility
Impetus Reclamation Ltd	Adjacent To North Tees Access Road, Port Clarence, Middlesbrough, Cleveland	3.8 Km	Non-hazardous physical treatment facility (mobile plant)
Green North East Trading Bidco Limited	Reclamation Pond Materials Recycling Facility, North Tees Access Road, Port Clarence, Stockton on Tees	3.8 Km	Residual industrial, commercial and municipal waste materials recycling facility
Ms M S M Birt, Mr F Spenceley & Mr F J Fensom	Cleveland Golf Club, Majuba Road, Redcar, Cleveland	3.9 Km	Deposit of soil for recovery

Operator	Address	Distance	Type of waste accepted
Ahmad Khileel	2, King George Terrace, South Bank, Middlesbrough, Cleveland	3.9 Km	End of life vehicle facility
Stephen Neary	Land/premises At, Old Station Road, South Bank, Middlesbrough, Cleveland	3.9 Km	End of life vehicle facility
Michael Hanley	Land/premises At, Smiths Dock Road, South Bank, Middlesbrough, Cleveland	3.9 Km	End of life vehicle facility
C L Prosser & Co Ltd	Land/premises At, Skippers Lane, South Bank, Middlesbrough, Cleveland	4.1 Km	Household, commercial and industrial waste facility
Augean North Limited	Port Clarence Non-Hazardous Landfill Site, Off Huntsman Drive, Cleveland	4.1 Km	Non-hazardous landfill
Augean Treatment Ltd	Port Clarence Landfill Site, Off Huntsman Drive, Stockton on Tees	4.1 Km	Hazardous & Non-hazardous Soil treatment facility
Augean Treatment Ltd	Port Clarence Landfill Site, Huntsman Drive	4.2 Km	Hazardous & Non-hazardous waste energy recovery plant comprising: gasification, plasma, thermal desorption, liquid waste treatment, anaerobic digestion & transfer
Mr & Mrs D Burbridge	Land/premises At, Dormer Way, Middlesbrough Road, South Bank, Middlesbrough Cleveland	4.3 Km	End of life vehicle facility
Biffa Waste Services Ltd	Brunel Road, Skippers Lane Ind Est, Middlesbrough, Cleveland	4.4 Km	Household, commercial and industrial waste treatment and transfer facility
J & B Recycling Limited	Land/premises At, Normanby Wharf, Dockside Road, Cargo Fleet, Middlesbrough, Cleveland	4.6 Km	Household, commercial and industrial waste transfer facility
Augean North Limited	Port Clarence Landfill Site, Off Huntsman Drive, Port Clarence, Stockton on Tees	4.6 Km	Hazardous waste landfill

Operator	Address	Distance	Type of waste accepted
Recyc-oil Ltd	Murdock Road Oil Treatment Plant, Murdock Road, Middlesbrough Industrial Estate, Middlesbrough, Teesside	4.7 Km	Oil treatment & recycling
C L Prosser & Co Ltd	Normanby Wharf, Dockside Road, Middlesbrough, Teesside	4.8 Km	Household, commercial and industrial waste transfer facility
Able UK Ltd	T E R R C, Graythorpe Dock, Tees Road, Hartlepool, Cleveland	4.8 Km	Teesside Environmental Reclamation & Recycling Centre – decommissioning marine structures
M P Storage & Blending Ltd	Deepwater Wharf, Dockside Road, Cargo Fleet, Middlesbrough, Cleveland	5.0 Km	Hazardous waste transfer station

3.4 Regional facilities

3.4.1 The potential regional waste management capacity has also been assessed. The Environment Agency provides waste capacity data on its website[1]. This data set was assessed to identify the remaining regional capacity according to waste management options in North East of England and Yorkshire & Humber. This provides an indication of whether the predicted waste types from the development can be managed within the Region in accordance with the proximity principle (i.e. managing wastes as close to the source of production as possible). The rWFD establishes the 'principle of proximity' in Article 16. The Proximity Principle recognises that transporting waste has environmental, social and economic costs so, as a general rule, waste should be dealt with as near to the place of production as possible.

3.4.2 **Figure 3-1** to **Figure 3-4** reproduce the Environment Agency's data tables**.** They provide an indication of the number of waste management facilities within North East England and Yorkshire & Humber; and the general capacity, according to their general type of operation. There are too many regional sites to list individually.

3.4.3 Note that treatment, transfer and recycling facilities, as well as incineration facilities, do not have a year-on-year diminishing capacity. Therefore, the data in the tables below are indicative of the likely overall annual capacity of these types of facilities year-on-year.

[1] Source: Environment Agency Waste Management Data Tables 2012 http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/research/library/data/150326.aspx

3.4.4 The specific waste streams that are predicted to be generated as a result of the proposed scheme are identified in **Section 5** (for construction wastes), **Section 6** (for operational wastes) and **Section 7** (for decommissioning wastes). These sections provide a discussion on whether the facilities described herein would be able to manage wastes from the proposed scheme according to the types of waste that are predicted to be generated and whether those wastes would be recovered on site; or would be recovered or disposed off-site.

Figure 3-1 Number of waste management facilities in England and Wales (2012)

England and Wales: Permitted waste facilities in 2012

Site type		Former Planning Region								
		North East	North West	Yorkshire & the Humber	East Midlands	West Midlands	East of England	London	South East	South West
Landfill	Number of sites with an environmental permit at end 2012	27	44	72	62	48	76	8	83	58
	Number of sites that accepted waste in 2012	25	43	55	45	31	51	7	53	45
Land Disposal	Number of sites with an environmental permit at end 2012	2	19	17	18	15	32	8	40	38
	Number of sites that accepted waste in 2012	-	9	7	4	8	18	6	28	27
Incineration	Number of sites with an environmental permit at end 2012	5	13	17	12	6	10	10	24	20
	Number of sites that accepted waste in 2012	3	9	12	7	11	4	7	16	9
Transfer	Number of sites with an environmental permit at end 2012	181	509	425	326	404	370	218	412	375
	Number of sites that accepted waste in 2012	145	377	324	223	263	301	177	332	313
Treatment	Number of sites with an environmental permit at end 2012	119	347	284	248	241	260	106	300	276
	Number of sites that accepted waste in 2012	86	217	218	171	150	191	70	242	203
Metal Recycling Site	Number of sites with an environmental permit at end 2012	157	394	403	248	385	296	107	229	275
	Number of sites that accepted waste in 2012	92	154	190	117	180	163	56	133	141
Use of Waste	Number of sites with an environmental permit at end 2012	8	20	23	22	25	14	2	33	60
	Number of sites that accepted waste in 2012	6	16	13	18	13	10	2	29	46
Total	Number of sites with an environmental permit at end 2012	499	1,346	1,241	936	1,124	1,058	459	1,121	1,102
	Number of sites that accepted waste in 2012	357	825	819	585	656	738	325	833	784

Figure 3-2 Remaining landfill capacity in North-East England and Yorkshire & Humber

North East Landfill Capacity 2012

All figures are provided in 000s cubic metres

Landfill Type	Sub-Region				NORTH EAST
	County Durham	Northumberland	Tees Valley Unitary Authorities	Tyne & Wear	
Hazardous Merchant	-	-	7,174	-	**7,174**
Hazardous Restricted	-	-	-	-	-
Non Hazardous with SNRHW cell*	2,462	1,252	1,197		**4,911**
Non Hazardous	1,764	50	6,606	8,260	**16,680**
Non Hazardous Restricted			-		-
Inert	8,110	871		2,589	**11,570**
Total	**12,336**	**2,172**	**14,977**	**10,849**	**40,334**

Yorkshire & the Humber Landfill Capacity 2012

All figures are provided in 000s cubic metres

Landfill Type	Sub-Region				YORKSHIRE & THE HUMBER
	Former Humberside	North Yorkshire	South Yorkshire	West Yorkshire	
Hazardous Merchant	895	-	-	-	895
Hazardous Restricted	-	-	-	-	-
Non Hazardous with SNRHW cell*	1,315	-	-	1,668	2,983
Non Hazardous	21,567	4,852	14,095	11,954	52,468
Non Hazardous Restricted	5,575	15,602	-	1,583	22,760
Inert	4,344	1,169	7,182	2,672	15,368
Total	**33,697**	**21,624**	**21,278**	**17,877**	**94,474**

Figure 3-3 **Transfer, treatment and metal recycling volumes in North-East England and Yorkshire & Humber**

North East - Transfer, Treatment & Metal Recycling Site Inputs 2012

All figures are provided in 000s tonnes

Site Type	Sub-Region				NORTH EAST
	County Durham	Northumberland	Tees Valley Unitary Authorities	Tyne & Wear	
Hazardous waste	63	0	42	562	668
HIC	203	237	464	845	1,750
Clinical	1	-	0	2	3
Civic amenity site	70	42	62	88	262
Non-biodegradable	14	110	-	22	146
Transfer Total	**351**	**390**	**568**	**1,519**	**2,829**
Material recovery	142	113	276	59	589
Physical	99	124	229	409	860
Physico-chemical	-	0	137	32	170
Chemical	-	4	-		4
Composting	43	95	-	40	179
Biological	8	-	2,433	154	2,595
Treatment Total	**291**	**336**	**3,076**	**694**	**4,397**
Vehicle depollution	13	19	31	4	66
Metal recycling site	18	1	442	259	721
Metal Recycling Sector Total	**31**	**20**	**473**	**263**	**787**

Yorkshire & the Humber - Transfer, Treatment & Metal Recycling Site Inputs 2012

All figures are provided in 000s tonnes

Site Type	Sub-Region				YORKSHIRE & THE HUMBER
	Former Humberside	North Yorkshire	South Yorkshire	West Yorkshire	
Hazardous waste	69	61	170	4	304
HIC	1,236	299	989	1,057	3,581
Clinical	-	-	0	8	8
Civic amenity site	82	76	64	243	466
Non-biodegradable	-	11	259	14	283
Transfer Total	**1,387**	**447**	**1,481**	**1,326**	**4,641**
Material recovery	100	119	70	719	1,008
Physical	719	161	947	830	2,658
Physico-chemical	18	20	174	310	521
Chemical	-	-	79	195	274
Composting	219	100	130	63	512
Biological	254	2	45	83	385
Treatment Total	**1,310**	**402**	**1,446**	**2,200**	**5,358**
Vehicle depollution	8	6	94	82	190
Metal recycling site	218	38	839	404	1,499
Metal Recycling Sector Total	**227**	**44**	**933**	**486**	**1,690**

Figure 3-4 Incineration capacity in North-East England and Yorkshire & Humber

North East - Incineration Capacity 2012

All figures provided in 000s tonnes

Incineration Type	Sub-Region				NORTH EAST
	Durham	Northumberland	Tees Valley Unitary Authorities	Tyne & Wear	
Animal By-Product	-	-	-	-	-
Animal Carcasses	-	-	-	-	-
Clinical	-	-	-	-	-
Co-Incineration of Hazardous Waste	50	-	-	-	50
Co-Incineration of Non Hazardous Waste	125	-	-	-	125
Hazardous	-	-	-	-	-
Municipal and/or Industrial & Commercial	-	-	375	-	375
Sewage Sludge	-	-	-	-	-
Total	**175**	**-**	**375**	**-**	**550**

Yorkshire & the Humber - Incineration Capacity 2012

All figures provided in 000s tonnes

Incineration Type	Sub-Region				YORKSHIRE & THE HUMBER
	Former Humberside	North Yorkshire	South Yorkshire	West Yorkshire	
Animal By-Products	270	-	-	-	**270**
Animal Carcasses	-	-	-	-	-
Clinical	-	-	-	22	**22**
Co-Incineration of hazardous waste	88	-	-	-	**88**
Co-Incineration of non hazardous waste	30	-	-	-	**30**
Hazardous	-	-	-	-	-
Municipal and/or Industrial & Commercial	56	-	225	150	**431**
Sewage Sludge	-	-	17	72	**89**
Total	**444**	-	**242**	**244**	**929**

3.4.5 The information provided for the local sites and regional capacity show that there are numerous waste management facilities providing a wide variety of waste management options within the region. The overall capacity data means that these facilities are likely to be capable of managing all of the conventional wastes requiring off-site management that are predicted to be generated by the proposed development during construction, operation and decommissioning.

4 OVERVIEW OF PROPOSED SCHEME

4.1.1 The proposed scheme would comprise the following elements:

- A port terminal on the southern bank of the Tees estuary (with capital dredging of an associated berth pocket and approaches).
- A conveyor system to transfer product to the port terminal, from a Materials Handling Facility (MHF) at Wilton (the MHF at Wilton is the subject of a separate planning application and is not considered in this assessment).
- Product storage facilities adjacent to the port terminal, in the form of surge bins.
- Staff welfare facilities.

4.1.2 Two options are being considered for the quay construction – an open quay structure and a solid quay structure.

4.1.3 Under the open quay structure option, the quay and access bridge structures would be suspended deck structures comprised of a reinforced concrete deck supported by driven steel tubular. The piles would support the concrete deck structures onto which the ship loader rails and supports for the conveyor would be fixed. The quay structure footprint envelope is anticipated to be up to 85m wide by 280m long in Phase 1, increasing up to a total of 550m long in Phase 2.

4.1.4 Under closed structure option, the quay structure would be a combi-pile wall comprised of a line of steel tubular king piles linked by pairs of steel sheet piles. The quay structure footprint envelope would be up to 85m wide by 280m long in Phase 1, increasing up to a total of 540m long in Phase 2. Access to the quay would be directly from the reclaimed area behind the quay wall.

4.1.5 The channel would be deepened within the area that would require dredging in the current approach channel from 10.4m below Chart Datum (bCD) to 14.1m bCD (to match the depth of the remainder of the approach channel downstream of this point to the mouth of the Tees). The approach channel dredging required would be the same for both the open quay structure and solid quay structure. It is proposed that dredging to 16m bCD would be undertaken to create the berth pocket.

Site compound and laydown area

4.1.6 A number of site compound/temporary storage areas of variable size are proposed throughout the proposed scheme footprint. These would operate in accordance with a 'just-in-time' logistical solution in order to minimise the take up of land. The site compound locations would be the same for Phases 1 and 2. The site compound would not be located on Bran Sands landfill.

Dredging of the approach channel and berth pocket

4.1.7 Capital dredging of the berth pocket (and approaches to the pocket) would be required in order to allow the maximum design vessels proposed access to the port terminal. Dredging would be undertaken in two phases and is linked to the phased construction of the quay. Dredging would also be required to create the stable slope beneath the quay for the open suspended deck option.

4.1.8 **Table 4-1** summarises the proposed capital dredging material quantities, split by material type, for Phases 1 and 2 of the construction of the proposed open quay. For this option, the total quantity of material to be dredged would be approximately 1,122,000m^3. The construction of the closed (reclamation) option would involve capital dredging of approximately 814,000m^3 because less material would require dredging from within the footprint of the quay structure compared with the open quay construction.

4.1.9 **Table 4-2** provides a summary comparison of dredged material volumes for the open and closed (reclamation) quay options. The capital dredge volumes quoted are based on available geotechnical information; further ground investigation is proposed during detailed design to confirm these quantities.

Table 4-1 **Summary of capital dredged material quantities and material types for Phases 1 and 2 (open quay configuration)**

	Capital dredge volume (m^3)				Total
Phase 1					
Silts	155,000				
Sands and Gravels		300,000			
Clays			180,000		
Mercia Mudstone				115,000	
Total (Phase 1)					**750,000**
Phase 2					
Silts	26,000				
Sands and Gravels		26,000			
Clays			50,000		
Mercia Mudstone				270,000	
Total (Phase 2)					**372,000**
Total (Phase 1 + Phase 2)	**181,000**	**326,000**	**230,000**	**375,000**	**1,122,000**

Table 4-2 **Summary of dredged material volumes for the open quay and closed (reclamation) quay options**

	Open quay (m^3)	Closed quay (m^3)
Silts	181,000	66,000
Sands and Gravels	326,000	196,000
Clays	230,000	194,000
Mercia Mudstone	385,000	358,000
TOTAL	**1,122,000**	**814,000**

4.1.10 For Phases 1 and 2, it is proposed that dredging of the silts would be undertaken using enclosed grabs, due to the elevated concentrations of contaminants present within the sediment (see below). **Table 4-1** shows that 181,000m^3 of silts would require dredging by this method.

4.1.11 The underlying sands and gravels below the silt layer represent the geological horizon; however, contamination is observed through the depth of the silt. Therefore, as a precautionary approach (given that further ground investigation is proposed), the EIA assumes dredging 181,000m^3 + the top 15% of

material below the silts (i.e. 208,150m^3) using an enclosed grab. This material would be subject to on-shore management as waste.

4.1.12 The proposed capital dredging would generate silts, sands, gravels, clay and rock, and the potential to use these materials (prior to proposing offshore disposal) has been considered. Alternative uses for the sands and gravels and the clay and mudstone can include habitat creation or improvement and use in reclamation projects; or off-shore disposal.

4.1.13 The use of material in reclamation in the marine environment and the deposit of material offshore would require authorisation for use under the marine permitting process (in this case via the deemed marine licence). The material must meet quality criteria for these options, determined by the licence. The off-shore disposal and marine permitting requirements are discussed further in the **ES Chapter 3** '**Description Of The Proposed Harbour Facilities'** (**Section 3.2**). The use of material in reclamation projects or habitat creation on land would be subject to the waste regulatory framework, unless it can be demonstrated that the material would cease to waste when use (see **Sections 5.1** and **5.2** below).

Conveyor system

4.1.14 The conveyor system is proposed to consist of two parallel belt conveyors running from the MHF at Wilton to the proposed port terminal. Further information about the conveyor system is provided in **Chapter 3** '**Description Of The Proposed Harbour Facilities', Section 3.1**. The polyhalite product would not be exposed to the atmosphere at any point along the conveyor system because it is important that the product remains dry.

4.1.15 Two alternative options are proposed for the alignment of the conveyor route at the south-eastern corner of the Bran Sands landfill site; resulting in a study area envelope (two corridors) that runs either along the northern or southern boundary of the landfill site. Only one corridor would be adopted. The option that would be implemented is dependent on detailed structural surveys.

5 MANAGEMENT OF WASTES DURING CONSTRUCTION

5.1 Dredgings - Contaminated silt

5.1.1 The onshore management of the contaminated silt layer (assumed to be 224,250m^3) is discussed below.

5.1.2 It is proposed that the contaminated silt layer would be either be recovered on land, or sent for disposal on land, following suitable treatment. The treatment would take place at an off-site facility that holds an appropriate authorisation.

5.1.3 A sediment quality survey of the proposed dredging (and quay construction) areas has been undertaken as part of the EIA process.

5.1.4 Vibrocore samples were taken from nine sampling points, seven in the proposed berth area and two outside of the proposed berth area to identify generic background contamination level in the main river channel. Sub-samples were taken at depth intervals through each vibrocore. Further details are provided in the ES (**Section 7.4**).

5.1.5 The sediment quality data generated by the vibrocore survey was assessed to identify whether any samples exceed the hazardous waste thresholds, which would have an important bearing on potential disposal or reuse options for the sediment on land.

5.1.6 The hazardous waste assessment was made on each of the 38 sediment samples in accordance with WM2 'Hazardous Waste: Interpretation of the definition and classification of hazardous waste' 3rd Edition[2] (2013). The hazardous waste assessment is reported in the Hazardous Waste Assessment, which is provided as **Annex A** to this technical appendix.

5.1.7 Several samples were observed to exceed the thresholds for the relevant hazardous waste thresholds. These are provided below in **Table 5-1**.

Table 5-1 Samples observed to exceed hazardous waste thresholds

Hazardous Property	Sample / depth				
	< 1m	< 2m	< 3m	< 4m	< 5m
Very toxic (H6)	x	x	VC04 2m VC08A 2m	VC05 3.48m VC05A 3.78m VC07 3m	VC07 4.87m
Carcinogenic (H7)	VC03A 0m	VC07 1m VC08A 1m	VC04 2m VC05 2m VC07 2m VC08A 2m	VC04 3m VC05 3m VC05 3.48m VC05A 3.78m VC06 3m VC07 3m VC08A 3m	VC04 4m VC06 4.18m VC07 4m VC07 4.87m
Toxic for reproduction (H10)	x	x	x	x	x

[2] https://www.gov.uk/government/publications/hazardous-waste-technical-guidance-wm2

Hazardous Property	Sample / depth				
	< 1m	< 2m	< 3m	< 4m	< 5m
Mutagenic (H11)	VC03A 0m	VC07 1m VC08A 1m	VC04 2m VC05 2m VC07 2m VC08A 2m	VC04 3m VC05 3m VC05 3.48m VC05A 3.78m VC06 3m VC08A 3m	VC04 4m VC06 4.18m VC07 4m VC07 4.87m
Ecotoxic (H14)	x	x	VC04 2m VC08A 2m	VC05 3.48m VC07 3m	VC07 4.87m

5.1.8 None of the samples from vibrocore locations in the main channel (VC01 and VC02) were reported as exceeding the hazardous waste thresholds.

5.1.9 Surface hydrocarbon contamination at vibracore location VC03A, and at 1m for vibrocore locations VC07 and VC08A, caused an exceedance of the threshold for hazardous properties H7 and H11 (carcinogenic and mutagenic, respectively). Otherwise, the bulk of the samples showing exceedances of the hazardous waste thresholds were from depths between 2m and <5m. These exceedances were caused by elevated hydrocarbons and heavy metals (chromium, copper, zinc).

5.1.10 Exceedances were observed at all depths of the silt layer within the proposed dredge area, with the exception of vibracore location VC03A, where exceedances were only observed at the surface.

5.1.11 All of the sampling points from the dredged area provided one or more samples that exceeded the hazardous waste thresholds; therefore, on a precautionary basis the silt layer as a whole should be dealt with as a hazardous waste.

Regulatory options for management of contaminated silt on-shore

5.1.12 If sediment is deposited on land (i.e. above mean high water spring tide level) it may be subject to the waste regulatory framework. The deposit of waste material on land usually requires an environmental permit, unless an approved non-regulatory solution can be demonstrated to be appropriate for the proposed use. The following measures would be implemented for any waste sediment deposited on land to ensure that this is carried out in accordance with relevant legislative principles.

5.1.13 It is a legal requirement for waste producers/holders to follow the waste hierarchy when making decisions about waste management options for waste. Waste holders have to demonstrate that the highest appropriate hierarchical option has been selected. Lower hierarchical options cannot be justified by cost alone. They require environmental justification over available higher options. An interpretation of the hierarchical options is provided below.

5.1.14 The dredged contaminated silt cannot be prevented, because dredging would occur due of the works and, given the nature of the material, it cannot meet the definition of 'prepared for reuse'.

5.1.15 There are no Quality Protocols specifically for marine sediment. However, it is noted that the Waste & Resources Action Programme (WRAP) Aggregates Quality Protocol includes non-hazardous marine sediment in the list of acceptable wastes, as long as it can be demonstrated that the sediment is inert and does not include any fines. This Quality Protocol requires that the sediment is subjected to treatment at a waste management facility, where it is processed into a secondary aggregate product using factory-control-procedures. This process would generate a marketable secondary aggregate that is suitable for use in any location that requires the specified product. It is noted that the hazardous waste assessment process confirms the presence of contamination; therefore, the contaminated silt would not meet the definition of 'inert' and, consequently, there are no recycling options available.

5.1.16 The silt could be reused for construction purposes (e.g. as low grade fill or as a defined-specification engineering material (after suitable treatment)). It must be deemed 'suitable for use' according to several criteria (see below). It would need to be dewatered before it is suitable for recovery.

5.1.17 Reuse for construction is technically considered to be 'other recovery' and would be a lower option than recycling. However, it does have several advantages, particularly if the sediment is recovered for use within the development or in another proposed local development scheme, namely:

- It is the best possible option when considering the proximity principle (i.e. managing the material as close to the site of production as possible).
- Reuse of the material would prevent the need for using similar quantities of virgin aggregate that would be used for the same purpose, thus saving natural resources.
- Managing the material as close to the site of production as possible is likely to generate less emissions compared with transport of virgin material to site; or removal of sediment from site for treatment or disposal; and any emissions associated with off-site treatment and subsequent return to site as a recycled product.

5.1.18 The lowest available option for the silt would be to dispose of it. Landfilling can only be considered as a justified option once all other options have been discounted. It is contrary to the waste hierarchy to justify landfill by means of convenience or cost.

5.1.19 The appropriate waste hierarchical options for the management of the contaminated silt are:

- Removal and off site treatment followed by recovery (use in construction) at another site; or,
- Disposal following treatment.

5.1.20 The contaminated silt would be too wet to be directly used or disposed following dredging and would require dewatering prior to any disposal or reuse option. This is the minimum treatment requirement prior to all on-shore options. The option to provide a dedicated dewatering facility does not form part of the proposed scheme and, therefore, dewatering would be required at a facility located off-site.

5.1.21 Water that has drained from hazardous material would not be allowed to be discharged back into a watercourse (including the one from which the contaminated silt was dredged) unless the discharge complies with the conditions of an environmental permit.

5.1.22 The wet sediment is a waste and would be subject to waste regulatory control if it were removed from the site.

5.1.23 It is not possible at this stage to ascertain whether the sediment would be directly suitable for any re-use option or disposal directly after it is dewatered. A detailed quantitative risk assessment would be required at the site of the proposed use. Further treatment, such as chemical stabilisation, may be required to remove or reduce the risk to an acceptable level prior to any proposed recovery for reuse.

5.1.24 The contaminated silt is classified as hazardous, therefore, any land-based storage of the material pending recovery, treatment or disposal would be required to ensure that any water discharge arising from storing the sediment whilst wet is contained. Storage would be on an impermeable surface or within a sealed drainage system i.e. not the Bran Sands lagoon.

5.1.25 Prior to the commencement of dredging, the site would be registered as a hazardous waste producer in accordance with the requirements of the Hazardous Waste Regulations 2005 (as amended).

5.1.26 Hazardous Waste Consignment notes would be prepared by (or on behalf of) the dredging contractor before the contaminated silt is removed from the dredging area for each movement of the material to an off-site treatment, recovery or disposal facility.

5.1.27 The removal of the contaminated silt from the dredged area would be by a person or company authorised to carry waste (i.e. is a registered waste carrier or can prove that they are exempt or excluded).

5.1.28 Treatment of the contaminated silt is a waste operation and requires an environmental permit for the operation whether it is carried out at a fixed facility; or using Mobile Plant.

5.1.29 If treatment can be provided using mobile plant equipment, it would be the responsibility of the mobile plant operator to obtain the mobile plant permit for the operation, and in addition, they would need to obtain a deployment form authorised by the Environment Agency to carry out the activity at the proposed location.

Quay construction options

5.1.30 For the closed (reclamation) option for the quay construction, it is proposed that a proportion of the uncontaminated dredged material would be used as infill. Contaminated silt would not be used.

5.1.31 For the open quay construction option, there is no requirement for fill.

Recovery of the sediment for reuse in construction off-site

5.1.32 Where the proposed treatment (either using an onsite mobile plant, or at an off-site facility) is intended to produce a construction material to a defined specification for reuse, a method statement would be required to provide a framework to ensure that the material achieves the defined specification. This would enable it to be 'suitable for use'. The method statement would provide:

- Acceptance criteria to define which wastes are suitable for the treatment process and a method for rejecting unacceptable wastes.
- A technical or engineering specification that the treated material must meet.
- A sampling and testing methodology to assess the treated material against the specification.
- Procedures to reject out-of-specification treated material.

5.1.33 If the contaminated silt is to be re-used in construction, then the proposed activity must meet the criteria for a beneficial recovery operation. Evidence must be provided to demonstrate the following:

- Is there a clear benefit from the activity?
- Is the waste material suitable for its intended use?
- Is the minimum amount of waste being used to achieve the intended benefit?
- Is the waste being used as a substitute for non-waste material?
- Will the proposal be completed to an appropriate standard?

5.1.34 If the proposed activity does not meet these criteria, it would be considered a disposal operation.

5.1.35 The hazardous waste assessment has identified that the contaminated silt is hazardous. Therefore, this waste type is not acceptable under any exemption or standard rules permit that is applicable for the use of the sediment as waste in construction.

5.1.36 A bespoke environmental permit would be required to use the dredged contaminated silt after treatment **as waste** in a construction project, because the contaminated silt is hazardous. The bespoke permit would require a comprehensive application package, including a detailed environmental risk assessment and a management system that would provide a control system to ensure that the proposed activities would not cause unacceptable harm to human health or the environment.

5.1.37 There is an alternative option to the requirement to have an environmental permit. The CL:AIRE Definition of Waste: Development Industry Code of Practice (the CoP) would apply to the re-use of contaminated silt, where there is a need to use the material as part of the construction programme. For this option to be feasible, there would need to be a suitable scheme that requires the use of the appropriate volume of material AND an appropriate treatment regime to ensure that the material would be suitable for use within the scheme.

5.1.38 Regular liaison with the regulatory authorities should be maintained throughout the process to ensure all parties are aware of the application of the CoP on the development and that the appropriate lines of evidence are provided to ensure that the CoP principles can be met.

5.1.39 The CoP is supported by the Environment Agency. It sets out the principles for achieving a non-waste status by setting a risk-based approach to re-use. The use of contaminated material, including dredged sediment, is included within the scope of the CoP. The CoP is subject to self-regulation, via the use of an independent assessment by a Qualified Person, who is a person that fulfils the required experience, qualifications and professional membership criteria set by CL:AIRE.

5.1.40 The CoP requires evidence that the following principles have been met in full to determine that the contaminated silt ceases to be waste when it is used within a development:

- The proposed use of the material must not cause any harm to human health or the environment.

  A risk assessment for the specific end use is required following the principles defined in Model Procedures for the Management of Land Contamination, Environment Agency, 2004 (Contaminated land report 11, 'CLR11'). This would find out whether any contaminants from anthropogenic and/or natural sources present an unacceptable level of risk to human health, controlled waters, ecosystems and/or the built environment, based on the available pathways and receptors. If the level of risk is unacceptable after treatment, the CoP cannot apply to the material, therefore, it would be a waste and an environmental permit would be required for reusing the material.

- The material is suitable for its proposed use.

  This would take into account the chemical and geotechnical requirements of the material in relation to a specification defined for their end use.

- The material must not require further treatment prior to use.

  The material must be suitable for use in all respects without treatment. If it requires treatment, it is waste. However, it can be deemed a non-waste after treatment (i.e. dewatering) if it is suitable for use.

- The use of the material is certain.

  The holder must be able to demonstrate that all of the material would be used and that use is a certainty, not a probability. The use of the dredged sediment must form part of the detailed design, so it can be clearly identified where in the scheme the material would be used and how much would be used. The movement of the dredged sediment from the dewatering process to final use must be clearly identified. This would require a Materials Management Plan to be prepared to show how and where all materials on the ground are to be dealt with. A tracking system must be defined to cover any waste/material movements and also contingency measures must be defined (i.e. who takes responsibility for and what happens in the event that the material is not suitable for use).

- Only a sufficient quantity of material would be used.

  The material must be destined for a defined purpose, to be defined in the scheme design. The quantity of material required for that purpose must be known prior to construction. If excess material is deposited to undertake that purpose, this is an indication that it is being discarded and it would be considered to be waste.

5.1.41 The contaminated silt would not be suitable for use immediately after being dredged because it is wet. However, the CoP allows for the treatment of material as part of a simple 'hub and cluster' arrangement at a permitted facility (which is referred to as the 'hub' site). The principles of the CoP would be applied to the use of the treated material from the hub site, at the proposed receiver site.

5.1.42 The proposed treatment of the hazardous sediment prior to use would be designed to reduce the levels of contaminants to below the hazardous waste thresholds and to levels that are below levels of contamination at the intended receiver site. This applies irrespective of whether the site-specific circumstances mean that the material could be successfully used.

5.1.43 Evidence would be provided to demonstrate through design that the material would be used with defined quantities provided prior to use. A Materials Management Plan (MMP) would be prepared to show how and where all materials on the ground are to be dealt with; and a tracking system to monitor any waste/material movements. Contingency measures would be defined (i.e. who takes responsibility and what happens in the event that the material is not suitable for use).

5.1.44 The MMP would be independently reviewed by a Qualified Person. The Qualified Person would provide a Declaration that the principles of the CoP have been complied with before construction could begin.

Disposal on land

5.1.45 Landfill disposal is a potential option for on-shore management where there are no feasible options available to recover part, or all of the contaminated silt on land or where the level of contaminants in the sediment mean that it is unsuitable for use.

5.1.46 The key aspects of landfill requirements for disposal of the contaminated silt would be pre-treatment (which as a minimum must include dewatering) and compliance with the hazardous Waste Acceptance Criteria (WAC).

5.1.47 It is a legal requirement that all wastes going for landfill must be pre-treated, unless treatment is not technically possible (applies to inert wastes only) and for other wastes, if treatment would not reduce the quantity or the hazards that it poses to human health or the environment. The proposed pre-treatment option must comply with the definition of 'treatment'. This involves a 'three-point test':

1. It must be a physical, thermal, chemical or biological process including sorting.
2. It must change the characteristics of the waste, and

3. It must do so in order to:
    - reduce its volume; or
    - reduce its hazardous nature; or
    - facilitate its handling; or
    - enhance its recovery.

5.1.48 The purpose of this pre-treatment is to:

- reduce the amount of waste going to landfill.
- reduce the impact of waste when it is landfilled.

5.1.49 Dewatering is a physical process that changes the physical characteristics of the waste and reduces its volume. It does not reduce the hazardous nature of the material, but facilitates its handling within the confines of a landfill because liquid wastes are banned from landfill. Therefore, dewatering would satisfy the requirements of pre-treatment.

5.1.50 Dewatering would not change the classification of the material from hazardous to non-hazardous, because it has not altered the chemical composition of the waste.

5.1.51 The sediment is a hazardous waste, therefore, for disposal, it could only be sent to a hazardous class of landfill. The hazardous waste must be tested to demonstrate that the levels of contamination fulfil the hazardous waste acceptance criteria[3] (Hazardous WAC) before it can be sent to landfill. These are a series of chemical leaching tests that are designed to mimic the behaviour of a waste in a landfill. The sediment would not be landfilled if it failed the Hazardous WAC. If this happened, the waste would be subjected to further treatment to lower the relevant concentrations of contaminants to below the Hazardous WAC thresholds.

5.1.52 The information provided in **Section 3** identifies that there are local and regional treatment and disposal facilities that are likely to be able to receive contaminated silt. There is no scope for the wet sediment to be stored within the proposed scheme footprint. Where contaminated silt is required to be removed from the dredge area to off-site treatment, recovery or disposal facilities, the mode of transport would be by barge.

5.2 Dredgings – uncontaminated material

Habitat enhancement in Bran Sands Lagoon

5.2.1 It is proposed that some of the sand and gravel from capital dredging during Phase 1 would be used within Bran Sands lagoon as part of habitat enhancement proposals that form part of the proposed

[3] The Waste Acceptance Criteria ('WAC') are defined in Council Decision 2003/33/EC established criteria and procedures for the acceptance of waste at landfills, pursuant to Article 16 of and Annex II to Directive 1999/31/EC (the Landfill Directive)

scheme. This is described in more detail in **Chapter 3** '**Description Of The Proposed Harbour Facilities'**, **Section 3.1**, and is summarised below.

5.2.2 The habitat enhancement proposals would comprise the placement of dredged material within the lagoon to raise bed level in order to create a new shallow area of water and intertidal margins and, therefore, provide a feeding habitat for waterbirds. A layer of finer maintenance dredged material (mud), of up to 20cm in depth, would be placed over the sand and gravel to enhance the value of the area for feeding waterbirds. A bund of dredged clay or mudstone would be put in place. Sand, gravel and maintenance dredged material would be placed behind the bund to prevent migration of the placed dredged material from the deposition area across Bran Sands lagoon.

5.2.3 Sands and gravels would also be scattered onto the surface of the clay islands that also form part of the habitat enhancement proposals.

5.2.4 The total volume of sand and gravels that would be used in the habitat enhancement would be approximately 15,000m^3 to 20,000m^3.

5.2.5 A proportion of the capital dredged clay and mudstone would be used to create a series of islands in Bran Sands lagoon to provide roosting and nesting habitat for waterbirds. The volume of clay / mudstone that would be used to create islands would be approximately 3,000m^3 to 5,000m^3, depending on the number and size of islands that are created. Sands and gravels would be scattered onto the surface of the islands to provide a more suitable substrate for use by waterbirds.

5.2.6 The lagoon is above mean high water spring tide level, therefore, the use of the material within the lagoon would technically constitute the deposit on land. The deposit of this material into the Bran Sands lagoon would be subject to the waste regulatory framework and would require an environmental permit, unless a suitable waste exemption or approved non-regulatory solution could be demonstrated to be appropriate for the proposed use.

Waste exemption

5.2.7 The uncontaminated dredged sands & gravels and mudstone would not be hazardous waste. There is a waste exemption that allows the use of uncontaminated sediment for construction 'U1 use of waste in construction'. This exemption does not permit the use of any waste for land reclamation. This permits the use of up to 5,000 tonnes of uncontaminated sediment for drainage work carried out under the Land Drainage Act 1991, the Water Resources Act 1991 or the Environment Act 1995; or 1,000 tonnes for other construction purposes. Therefore, this exemption will not be suitable for the creation of the habitat enhancement.

Environmental permit

5.2.8 An environmental permit is required where a waste operation does not meet the requirements of an exemption. The permit sets the conditions that must be followed by the operator to prevent the operation from causing harm to human health or the environment.

5.2.9 There are two tiers of environmental permit available in England and Wales: standard-rules permits or bespoke permits.

5.2.10 Standard rules permits are 'off-the-shelf' permits that are not site specific and contain a standard set of rules that are applicable to particular waste management operations regardless of location. The rules cannot be varied and exclude waste operations in sensitive locations.

5.2.11 The standard rules have the following general restrictions - The activities shall not be within:

- groundwater Source Protection Zones 1 or 2;
- 50 metres of any spring or well, or of any borehole not used to supply water for domestic or food production purposes, and
- 250 metres of any borehole used to supply water for domestic or food production. within 500 metres of a European Site (for example a candidate or Special Area of Conservation (cSAC or SAC) and Proposed or Special Protection Area (pSPA or SPA) in England and Wales), Ramsar site or a Site of Special Scientific Interest (SSSI).

5.2.12 A standard permit does not allow any point source emissions into surface waters or groundwater.

5.2.13 There are standard permits that allow the use of non-hazardous sediment for construction purposes; one for up to 50,000 tonnes and the other for up to 100,000 tonnes (SR2010No7 and SR2010No8, respectively). *"Construction work"* means the carrying out of any building, civil engineering or engineering work and includes the building, alteration, conversion, repair, upkeep or other maintenance of a structure and the preparation of a site for an intended structure. It includes drainage works. This does not include land restoration or reclamation.

5.2.14 There are two other standard permits that also cover the use of waste excavated material on land, which has previously been subject to industrial or other man made development, where the specific purpose is to use waste for reclamation, restoration or improvement of the land. These are SR2010No9 and SR2010No10, for up to 50,000 tonnes and up to 100,000 tonnes respectively. These require that waste cannot be spread more than 2m deep; and that the reclamation, restoration or improvement of land must provide agricultural or ecological benefit.

5.2.15 If it is not possible to carry out the waste management operation in compliance with the full set of standard rules, as would be the case given the location of the Bran Sands lagoon, then a bespoke permit is required. A bespoke permit is site specific and involves a much more rigorous application process and compliance conditions.

CL:AIRE CoP

5.2.16 The principles regarding the CL:AIRE CoP, which are described in detail above in **Section 5.1** above, could also be applied to the use of the uncontaminated sediment.

5.2.17 The CL:AIRE CoP would be the preferred approach for the creation of the habitat enhancement, subject to the agreement of the Environment Agency, because it obviates the need to apply for and maintain an environmental permit.

5.2.18 The options for habitat enhancement were presented at a consultation meeting on 27 November 2014 attended by PINS, Natural England, the Environment Agency, the RSPB and the MMO, and the selection of the preferred approach and the detail of the design of the proposals will involve further discussion and agreement with these organisations.

Quay construction options

5.2.19 For the solid (reclamation) option for the quay construction, it is proposed that a proportion of the uncontaminated dredged material would be used as infill if it could be demonstrated that it would be suitable for use, by meeting a required specification to be determined at the detailed design stage in accordance with the CL:AIRE CoP. It is anticipated that the dredged material would be pumped directly into the reclamation area, with no stockpiling or active dewatering on land. The material would passively dewater. An environmental permit would be required for the dewatering process and discharge, as this would be considered as a waste treatment activity generating a point-source emission to controlled water under The Environmental Permitting (England and Wales) Regulations 2010 (as amended).

5.2.20 Should the solid (reclamation) quay configuration option be progressed, the balance of sands and gravels that are not used within the habitat enhancement proposals in Bran Sands lagoon would be used within the construction of the port terminal. For the open quay construction option, there is no requirement for fill and, therefore, an off-site recovery option, or disposal, would be required. Given that two options for the construction of the port terminal are under consideration and no other known uses for this material currently exist, the use of sands and gravels in the construction phase of the quay cannot be guaranteed. Consequently, it has been assumed that offshore disposal of sands and gravels would be necessary – see **Chapter 3** '**Description Of The Proposed Harbour Facilities'**, **Section 3.1** for further details.

5.3 Wastes from land-based excavations

5.3.1 Excavation wastes are anticipated to comprise non-hazardous soil and stones, and inert material. The following activities are likely to create excavation waste:

- Material excavated from above the mean high water springs level as a consequence of piling activity and preparation for the construction of quay.
- Material excavated as part of the construction of the surge silos.
- Material excavated as part of the construction of the proposed revetment wall for the open quay option.

- Excavation of Made Ground from the proposed conveyer route.
- Excavation of material to construct a new access road adjacent to Dabholm Gut in order to access the port terminal.

5.3.2 The nature of potential excavated wastes would be influenced by the historical use at the site. The area is currently not subject to activity that produces any regular waste arisings. However, there has been previous industrial activity on site that could influence the nature of excavated waste.

5.3.3 A large volume of Made Ground (generally thought to comprise slag) was used to raise a significant portion of the land within the scheme footprint and may represent a source of contamination. Given the industrial nature of the area, there may also be residual contamination associated with historical activities.

5.3.4 It is proposed that, where needed, excavated material would be retained on site for recycling or reuse in the proposed scheme for construction purposes (e.g. as part of the cut and fill), where it is suitable for use; otherwise, the material would be sent for recycling, treatment or disposal off-site, in accordance with the waste hierarchy.

5.3.5 Given the previous historic use of the area, a conservative view was taken that the extracted material would be considered non-hazardous, with potential for isolated pockets of contamination hotspots.

5.3.6 This material would either be retained on site for recycling or re-use in the proposed scheme, where it is suitable for use, or sent for recycling off-site. The information provided in **Section 3** identifies that there are many local and Regional facilities that can manage this waste.

5.3.7 As stated above, it is assumed that there may be residual contamination on site due to the previous site history. This has been considered separately below.

5.3.8 The CL:AIRE CoP can also be applied to the re-use of excavated material from the proposed scheme footprint. The same principles apply, with the designation of 'suitable for use' being dictated by the cut and fill requirements.

5.3.9 Stockpiles would be designed and positioned in order to minimise erosion, pollution of watercourse or increase flooding. All stockpiling would be undertaken at a safe distance from watercourses.

5.3.10 The use of the CoP would reduce the quantity of waste being managed, because if the principles of the CoP are followed, the excavated material would not be waste when used.

5.4 Contaminated excavation waste

5.4.1 **ES Chapter 6 Hydrology, Hydrogeology and Land Quality**, **Section 6.4** provides indicative concentrations of contaminants within material in the proposed scheme footprint. Based on this data, none of the hazardous waste thresholds are exceeded. However, due to the previous historical use of the proposed scheme footprint it is likely that contaminants may be present in localised areas on site,

so isolated hotspots of contamination at levels exceeding the hazardous waste thresholds cannot be ruled out.

5.4.2 This material would be sent for treatment pending recovery or landfill disposal off-site. The information provided in **Section 3** identifies that there is local and regional capacity for treatment or landfill facilities that are likely to be able to receive this waste for disposal.

5.4.3 Contaminated excavation waste would be stockpiled separately from other non-hazardous waste material to avoid cross-contamination. It would either be stored in covered skips or under covered stockpiles to prevent pollution from run-off.

5.4.4 This material would be removed from site as soon as possible to reduce stockpiling. The material that is destined for off-site management would be sampled and tested to determine whether it would be classified as hazardous waste or non-hazardous waste.

5.4.5 Contaminated excavated material should be sent to a soil treatment facility, where it has the potential to be recovered into a saleable product with the remainder being sent to landfill. The proportion that may be received for treatment compared to landfill would be determined by the results of the testing of samples of excavated material from the proposed development area.

5.4.6 Where the material is classified as hazardous and is required to be landfilled, further testing would be carried out to ensure that it meets the Hazardous Waste Acceptance Criteria.

5.4.7 Sending contaminated excavated material to a soil treatment facility with a view to recycling promotes the waste hierarchy. The information provided in **Section 3** identifies that there are regional treatment and landfill facilities available for this waste and, therefore, the environmental impact, is predicted to be minor.

5.5 Contractor waste

5.5.1 Contractors working on site would produce waste when carrying out office duties at the site compound and when taking refreshment. This waste is considered to be similar in composition to municipal waste and is, therefore, considered to be non-hazardous.

5.5.2 Some of this waste is anticipated to be sent for energy recovery or segregation for recycling. However, residual waste would be sent to landfill. The information provided in **Section 3** identifies that there are local and regional facilities available for recycling or recovering this waste, although some would require disposal.

5.5.3 An effective solution for managing waste from site contractors taking refreshment on site is to introduce a policy to require them to take their own waste home. This could significantly reduce the amount of waste produced.

5.5.4 The majority of the remaining waste material can be segregated into dry-recyclable streams (e.g. paper, plastic bottles and metal cans). All receptacles for contractor waste should be clearly labelled and have lids to prevent wind-blown litter. Frequent collections of waste should be arranged to ensure that quantities on site are low (e.g. within the capacity of one covered skip); and waste is not retained on site for long periods to reduce scavengers and vermin.

5.5.5 The remaining residual waste should be sent for energy recovery where possible; however, it is likely that some would be landfilled, according to whether energy recovery facilities are available.

5.5.6 The measures are anticipated to significantly reduce the amount of waste on site at any one time; and increase the amount that would be recycled.

5.6 Excess / out-of-specification materials

5.6.1 Excess construction materials can arise where material is ordered in bulk to lower costs, but if some material remains unused where more material was ordered than needed these would become waste if discarded.

5.6.2 Out-of-specification construction materials or damaged materials, which do not comply with technical requirements, are waste when discarded.

5.6.3 There is likely to be a range of types of excess material, out of specification material, or damaged material comprising inert (e.g. concrete, bricks) and non-hazardous material (e.g. wood) arising during the construction phase of the proposed scheme.

5.6.4 The information provided in **Section 3** identifies that there is local and regional capacity within facilities that are likely to be able to receive this waste for reuse, recycling, or recovery.

5.6.5 Timely procurement and buying the required amount of material would ensure that the right amount of material is delivered at the time when it is needed. This would prevent waste from bulk purchasing.

5.6.6 Contractors should also ensure that perishable materials are stored so that they are protected from the local climate.

5.6.7 All damaged or off-specification material should be returned back to the supplier where possible, which would reduce the amount of wastage.

5.6.8 These measures are predicted to significantly reduce the amount of operational waste on site at any one time, so that the quantity would be low.

5.7 Packaging waste

5.7.1 Equipment and construction materials are usually delivered packed (e.g. wrapped/protected by plastic, secured on pallets, boxed in cardboard, etc.). Waste packaging is non-hazardous. Packaging waste would be removed from the site and recycled.

5.7.2 The information provided in **Section 3** identifies that there are local and regional capacity within facilities that are likely to be able to receive this waste for recycling.

5.7.3 To manage the impacts from packaging, suppliers should be required to take back any packaging associated with their products. This would assist the suppliers in fulfilling their own obligations under The Producer Responsibility Obligations (Packaging Waste) Regulations 2007 SI 2007 No. 871 (as amended).

5.7.4 Packaging materials that cannot be returned should be kept for on-site use (e.g. use of pallets for storage).

5.7.5 Any residual packing that cannot be used on site should be segregated into distinct dry recyclable waste streams and sent for recycling off-site. No waste packaging would be landfilled. It is anticipated that the amount of packaging retained on site at any one time is likely to be low.

5.8 Waste oil and empty drums

5.8.1 The operation and maintenance of plant equipment is likely to produce small quantities of waste oil and empty drums. These are classified as hazardous waste.

5.8.2 There is a widespread market in the UK for recycling of waste oil. The information provided in **Section 3** identifies local and regional capacity for facilities that are likely to be able to receive this waste for reuse, recycling and recovery.

5.8.3 Empty fuel or oil drums should be retained for reuse on site. Those that cannot be retained should be sent to a drum reconditioning facility to enable the containers to be prepared for re-use. Damaged drums should be sent for recycling. It is not anticipated that any drums would be sent for landfill.

5.8.4 The measures are anticipated to maximise waste managed at the highest waste hierarchical option and reduce the amount of waste sent off site.

5.9 Waste from spillages

5.9.1 The operation of construction plant equipment and the potential for storage of fuel and liquids on site during construction could lead to spillages. Absorbent would be used to clean up any spillages of contaminating material (e.g. oil) and contaminated absorbent would be classified as hazardous waste.

5.9.2 The use of an active maintenance regime on plant and equipment would reduce the potential for machinery to cause leaks. Valves, stopcocks and pipes would be regularly checked for leakages. Fuelling activities would be carried out in bunded areas, or off-site.

5.9.3 The storage of fuels and liquids would be in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001 and the appropriate pollution prevention control guidelines to protect the environment from both storage and spillages of hazardous substances:

- PPG 2 Above ground oil storage tanks.
- PPG 6 Working at construction and demolition sites.
- PPG 7 Refuelling facilities: good practice guidelines.
- PPG 8 Safe storage and disposal of used oils.
- PPG 22 Dealing with spills.
- PPG 26 Drums and intermediate bulk containers.

5.9.4 Using these guidelines would reduce the potential for leakages, therefore reducing the quantity of waste absorbent from the clean-up of spillages. It is unlikely that contaminated absorbent would be commercially viable for recycling or recovery of oil, depending on the level of oil in the material. Therefore, it is anticipated that this material would require disposal off-site, for treatment and / or landfill. The information provided in **Section 3** identifies that there are regional facilities available for dealing with this waste.

5.10 Miscellaneous hazardous waste

5.10.1 The construction activities are likely to generate small quantities of miscellaneous hazardous wastes, such as sealants, adhesives, resins, solvents, lead acid batteries and other used chemical products. These would be hazardous waste when discarded.

5.10.2 The information provided in **Section 3** identifies that there is Regional capacity in facilities that are likely to be able to receive such wastes for treatment / transfer / recovery, depending upon the nature of the material.

5.11 Generic management measures during construction

5.11.1 There are certain management measures that can be applied to the majority of wastes that are created during the construction phase. These are

- Adhere to waste legislation for storage and handling onsite; and transport and disposal / recycling / recovery off-site, at all times. Ensure that those who remove waste from site have the appropriate authorisation (i.e. are registered waste carriers) and those facilities that receive waste from the site hold a valid environmental permit, or an appropriate registered waste exemption.
- Allocate space on site for the storage of waste materials and ensure that storage areas and containers are clearly labelled so site workers know what wastes should be put there.

- Store hazardous waste separately from non-hazardous wastes to avoid contamination. Under the Hazardous Waste Regulations 2005 (as amended), it is illegal to mix hazardous waste with non-hazardous waste without a permit.
- Provide separate receptacles for dry recyclables, such as paper and cardboard, plastic, glass, wood and metal. This would encourage recycling and increase the potential value of the recyclable items by avoiding contamination.
- No waste would be deposited outside the boundary of the proposed scheme, unless it is in a site that holds a valid environmental permit. Off-site waste management facilities are legally obliged to operate under an environmental permit, which is in place to ensure that the site is operated in a manner to prevent emissions causing harm to human health or the environment.
- All wastes that are removed off site would be described on a waste transfer note or hazardous waste consignment note (as appropriate) that tracks the movement of the waste to the specified disposal or recycling facility.
- The appointed contractors would identify the staff that are responsible for waste management and ensure that all contractor staff are aware of the appropriate reuse, recycling or disposal routes for each waste.

6 MANAGEMENT OF WASTES DURING OPERATION

6.1.1 During the operational phase, the proposed scheme would facilitate the export of polyhalite product.

6.1.2 Vessels are anticipated to use the port terminal regularly. Wastes are likely to be limited to arisings from site operatives, cargo vessels, packaging and maintenance.

6.1.3 Maintenance dredging would also be required to ensure the berth pocket and navigation channel are maintained at the required depths. In line with current practice, this material would not be brought to shore and would be disposed of at the offshore disposal site in Tees Bay. Consequently, this material would have no impact on land.

6.2 Waste from site operatives

6.2.1 Waste would be created by site staff, particularly from office, canteen or rest areas and general waste produced on vessels. This waste is likely to be similar in composition to municipal waste and is, therefore, non-hazardous.

6.2.2 The information provided in **Section 3** identifies that there are local and regional facilities available for dealing with this waste, although some would require disposal.

6.2.3 For the remaining waste material, this material would be capable of being segregated into dry-recyclable streams (e.g. paper, plastic bottles and metal cans) and biodegradable waste streams (e.g. food waste).

6.2.4 All receptacles for contractor waste should be clearly labelled and have lids to prevent wind-blown litter. Frequent collections of waste should be arranged to ensure that quantities on site are within the

capacity of one-to-two covered skips and waste is not retained on site for long periods to reduce scavengers and vermin.

6.2.5 Segregation measures should be implemented at the medical facility to ensure that non-hazardous clinical wastes are not mixed with non-clinical wastes. This would reduce the amount of wastes sent for clinical waste treatment or incineration, which would also significantly reduce disposal costs.

6.2.6 Any non-recyclable mixed residual waste should be sent for energy recovery where possible; however, it is likely that some would be landfilled, depending upon the availability of energy recovery facilities.

6.2.7 These measures are anticipated to significantly reduce the amount of operational waste on site at any one time; and increase the amount that would be recycled.

6.3 Miscellaneous hazardous waste

6.3.1 The proposed operational maintenance activities are likely to generate small quantities of miscellaneous hazardous wastes, such as oils, sealants, adhesives, resins, solvents, paints and other used chemical products from minor maintenance. These would be hazardous waste when discarded.

6.3.2 Hazardous materials would be stored securely, away from non-hazardous or incompatible materials. Small items of hazardous waste would be prevented from being disposed of in general waste skips to avoid contamination.

6.3.3 The use of an active maintenance regime on plant and equipment would reduce the potential for machinery to cause leaks. Valves, stopcocks and pipes would be regularly checked for leakages. Fuelling activities would be carried out in bunded areas, or off-site.

6.3.4 The storage of fuels and liquids would be in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001 and the appropriate pollution prevention control guidelines to protect the environment from both storage and spillages of hazardous substances:

- PPG 2 Above ground oil storage tanks.
- PPG 6 Working at construction and demolition sites.
- PPG 7 Refuelling facilities: good practice guidelines.
- PPG 8 Safe storage and disposal of used oils.
- PPG 22 Dealing with spills.
- PPG 26 Drums and intermediate bulk containers.

6.3.5 Using these guidelines would reduce the potential for leakages, therefore reducing the quantity of waste absorbent from the clean-up of spillages. It is unlikely that contaminated absorbent would be commercially viable for recycling or recovery of oil, depending on the level of oil in the material. Therefore, it is anticipated that this material would require disposal off-site, for treatment and / or landfill. The information provided in **Section 3** identifies that there are regional facilities available for dealing with this waste.

6.3.6 Frequent collection of hazardous material should be implemented to minimise the total volume on site at any one time.

7 MANAGEMENT OF WASTES DURING THE DECOMMISSIONING PHASE

7.1.1 The proposed scheme is a long-term infrastructure proposal, with no plans to decommission the port terminal. As such, decommissioning of this aspect of the proposed harbour facilities has not been considered further.

7.1.2 The decommissioning of the conveyor system would comprise the complete removal of site infrastructure (including site wide utilities, concrete / steel structures, platforms, foundations and drainage systems) and remedial works in order to allow the site surfaces to blend into the surrounding environment.

7.1.3 These activities would produce waste materials. It would be the intention to ensure that wastes are kept on site and used within the restoration works, where possible. Wastes which are taken off-site would be dealt with in accordance with the waste hierarchy.

7.1.4 The information within **Table 7-1** provides a summary of the anticipated decommissioning works for the conveyor system that are likely to produce waste.

Table 7-1 Summary of decommissioning works for the conveyor system

Element of conveyor system	Decommissioning works	Wastes produced
Conveyors	• Making safe power supplies to the mechanical conveyors. • Disconnecting and removing electrical and control cables and removing from site. • Removal of any potential contaminants (e.g. transformer oil) from site. • Dismantling of mechanical conveyor motors and components and removal from site.	• Electrical cables • End-of-Life conveyor motors & components • Small quantities of Contaminated absorbent/spillages
Conveyor platform and structure	• Cutting of steel platforms and supports into transportable sections and lifting by crane onto lorries for recycling off-site. • Breaking and crushing of concrete superstructure elements for re-use on or offsite	• Steel cuttings • Concrete
Conveyor foundations	• Excavating the ground surface to expose the foundations. • Breaking foundations using a mechanical breaker prior to crushing for either on or offsite re-use.	• Concrete • Excavated soil & stones

Element of conveyor system	Decommissioning works	Wastes produced
Earthworks	• Filling voids from the conveyor platform foundations with appropriate backfill material. • Reinstatement of the ground surface to its previous condition.	• Excavated soil & stones
Ancillary buildings	• Removing all buildings and foundations up to 2m below ground level or to rock head. • Any demolition material suitable for backfilling would be crushed and re-used.	• Mixed demolition waste
Utilities	• Removing all utility apparatus and utility service trenches. • Reinstating service trenches.	• Cables & ducting • Electrical equipment
Fencing	• Removing security fencing and transporting off-site for potential re-use. • Agricultural boundary fencing demarking the site boundary would be maintained.	• Metal fencing

7.1.5 It is not known at this stage what the anticipated quantities would be, nor the exact types of wastes that would be produced during decommissioning of the conveyor route, because the final route and design has yet to be established. This information would be clarified at the detailed design stage. The most significant waste streams in terms of quantity are predicted to be inert materials, excavated materials and waste metal.

7.1.6 On the basis of current waste management practices, the following general management principles would be applied to the wastes:

- Electrical cables, ducting and pipelines would be assessed to identify whether they are suitable for preparing for reuse. If not, they would be sent for recycling.
- Electrical components and equipment would be assessed to identify whether they can be repaired or prepared for reuse. If not, they would be sent to an authorised processing facility for waste electrical and electronic equipment (WEEE).
- All waste metal would be sent for recycling.
- Waste concrete and other inert materials would be crushed and reused on site as part of the decommissioning backfill operation. Where surplus material occurs, this would be sent for recycling at a local aggregates recycling facility; or would be reused as fill in another development, under the appropriate regulatory regime in force at the time.
- It is anticipated that excavated materials would comprise inert soil and stones; and all of this material would be used as part of the decommissioning backfill operation. Where surplus material occurs, this would be sent for recycling at a local aggregates recycling facility; or would be reused as fill in another development, under the appropriate regulatory regime in force at the time.
- Demolition techniques would be implemented that allow the different types of waste to be separately stockpiled to maximise reuse or recycling potential.

- The types of demolition waste produced would be a mix of inert (concrete, bricks, tiles, cement) and non-hazardous (glass, wood, plastic, metal) wastes. At present, it is anticipated that the inert materials would be used for backfill; and the non-hazardous materials would be removed from site.
- Contaminated absorbents or soil from spillages would be tested against the appropriate criteria in force to identify whether they are hazardous wastes, and would be disposed of accordingly.
- All hazardous wastes would be stored separately non-hazardous wastes or incompatible materials, in secure, sealed containers to avoid cross-contamination.

7.1.7 On the basis of information provided in **Section 3**, at the present time there are current local and Regional facilities that are capable of managing all of the anticipated wastes from decommissioning.

7.1.8 However, the likely waste management techniques or legislative requirements for handling the wastes generated at the time of decommissioning cannot be predicted, given that it is predicted to occur decades in the future. There is no guarantee that any of the current waste management facilities would be operational, or whether new facilities would be available at the time of decommissioning.

8 SUMMARY

8.1.1 This section has assessed the predicted waste arisings that are likely to be produced during the construction, operation and decommissioning of the proposed scheme.

8.1.2 **Table 8-1** presents a summary of the proposed waste management measures used to minimise the adverse impacts of waste arisings from the construction, operation and decommissioning phases of the proposed scheme. To ensure that the proposed management measures are carried forward into the proposed development, they will be included as part of the Construction Environmental Management Plan (CEMP).

Table 8-1 Summary of the effect of waste management

Phase	Waste type	Management measures
Construction	Dredged sediment	Dewatering and appropriate treatment and recovery using the CL:AIRE CoP Appropriate pre-treatment, WAC testing and disposal in engineered hazardous waste landfill
	Wastes from excavation	Use of CL:AIRE CoP
	Contaminated excavation waste	Sampling and analysis; soil treatment off-site
	Contractor waste	Segregate dry recyclables; take own waste home
	Excess / out-of-specification materials	Timely procurement; order what is needed, not in bulk; return to suppliers
	Waste from spillages	Active maintenance; check for leaks; follow PPG guidelines

Phase	Waste type	Management measures
	Packaging	Send packing back to suppliers Reuse on site
	Oily waste	Reuse drums on site; send to drum reconditioning facility
	Miscellaneous hazardous waste	Stored securely, away from non-hazardous or incompatible materials to avoid cross-contamination
Operation	Waste from site operatives	Segregate dry recyclables; take own waste home
	Miscellaneous hazardous waste	Stored securely, away from non-hazardous or incompatible materials to avoid cross-contamination
Decommissioning	Electrical components and equipment	Assessed for repair or prepared for reuse. Otherwise sent to an authorised processing facility for waste electrical and electronic equipment (WEEE)
	Inert materials	Crush and reuse in on-site decommissioning backfill operations
	Mixed demolition material	Demolition techniques that allow the different types of waste to be separately stockpiled to maximise recycling potential
	Excavated material	Crush and reuse in on-site decommissioning backfill operations
	Metal wastes	Sent for off-site recycling
	Contaminated absorbent / soil from spillages	Sampling and analysis; soil treatment off-site Stored securely, away from non-hazardous or incompatible materials to avoid cross-contamination

9 REFERENCES

Department for Communities and Local Government, Updated national waste planning policy: Planning for Sustainable waste management (July 2013) Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/225581/Updated_national_waste_planning_policy_-_Planning_for_sustainable_waste_management_-_Consultation.pdf

Department for Communities and Local Government, Environmental report on the revocation of the north east of England plan (2011). Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/49493/Environmental_report_on_the_revocation_of_the_north_east_plan_2011_-_consultation_outcome.pdf

Government Waste Strategy 2007, Defra, (2007) http://archive.defra.gov.uk/environment/waste/strategy/strategy07/documents/waste07-strategy.pdf

Waste Strategy Annual Progress Report 2008/09, Defra, (2009) (http://archive.defra.gov.uk/environment/waste/strategy/documents/waste-strategy-report-08-09.pdf).

Government Review of Waste Policy in England 2011, Defra (2011) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69401/pb13540-waste-policy-review110614.pdf

Survey of Commercial and Industrial Waste Arisings 2010, Defra (2010) (https://www.gov.uk/government/publications/commercial-and-industrial-waste-generation-and-management

Planning Policy Statement 10: Planning for Sustainable Waste Management (PPS10), DCLG, 2011 Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/11443/1876202.pdf
National Planning Policy For Waste, DCLG, 2014, https://www.gov.uk/government/publications/national-planning-policy-for-waste

BS 5906:2005 - The British Standard on Waste Management in Buildings, BSi, (2006)

Environmental Permitting (England and Wales) Regulations 2010 (as amended), SI No. 2010 No. 675

Waste Framework Directive (2008/98/EC)

Waste (England and Wales) Regulations 2011 SI 2011 No. 988

The Producer Responsibility Obligations (Packaging Waste) Regulations 2007 SI 2007 No. 871 (as amended)

Control of Pollution (Oil Storage) (England) Regulations 2001, SI No. 2001 No. 2954

PPG 2 - Above ground oil storage tanks.

PPG 7 - Refuelling facilities: good practice guidelines.

PPG 8 - Safe storage and disposal of used oils.

PPG 22 - Dealing with spills.

PPG 26 - Drums and intermediate bulk containers.

Redcar & Cleveland's Sustainable Environment Strategy 2011 – 2016

Joint Minerals and Waste Development Plan Documents for the Tees Valley, The Tees Valley Joint Strategy Unit (JSU), (2011)

Royal HaskoningDHV (2014). York Potash Project Harbour Facility, Preliminary Environmental Report

ANNEX A

HAZARDOUS WASTE CLASSIFICATION ASSESSMENT

[Blank Page]

Royal HaskoningDHV
Enhancing Society Together

YORKPOTASH
A **Sirius Minerals** Project

Appendix 3.1: Waste Management – ANNEX 1 – Hazardous Waste Assessment

[Blank Page]

Document title: Appendix 3.1: Waste Management – ANNEX 1 – Hazardous Waste Assessment
Status: Final
Date: December 2014
Project number: 9Y0989
Client: York Potash Ltd
Client contact: James Barrie

Drafted by: Gary Bower
Checked by: Matt Simpson
Date / initials check: 24/11/2014 MS
Approved by: Sian John
Date / initials approval: 10/12/2014 SAJ

[Blank Page]

[Blank Page]

1 INTRODUCTION

1.1.1 Vibrocore samples were taken from nine sampling points, seven in the proposed berth area and two outside of the proposed berth area to identify generic background contamination level in the main river channel. Sub-samples were taken at depth intervals through each vibrocore. Further details are provided in the ES (Section 7.4).

1.1.2 The silt quality data generated by the vibrocore survey was assessed to identify whether any samples exceed the hazardous waste thresholds, which would have an important bearing on potential disposal or reuse options for the silt on land. This hazardous waste assessment will be used to inform a separate feasibility study looking into the potential options for management of contaminated silt on land.

1.1.3 The samples were analysed and presented in the laboratory analysis report J-2646 (dated 04/09/2014). This report describes the method used to assess the data from the J-2646 analyses to identify whether any samples could be considered to be hazardous waste or not.

1.1.4 The outcome of the assessment is presented in Section 3 and is summarised below.

1.1.5 Several samples were observed to exceed the thresholds for the relevant hazardous waste thresholds. These are provided in Table 1.1.

1.1.6 None of the samples from vibrocore locations in the main channel (VC01 and VC02) were reported as exceeding the hazardous waste thresholds.

1.1.7 Surface hydrocarbon contamination at vibrocore location VC03A and at 1m for vibrocore locations VC07 and VC08A caused an exceedance of the threshold for hazardous property H7 and H11 (carcinogenic and mutagenic, respectively). Otherwise, the bulk of the samples showing exceedances of the hazardous waste thresholds were from depths between 2m and <5m. These exceedances were as a combination of hydrocarbons and heavy metals (chromium, copper, zinc).

1.1.8 Exceedances were observed at all depths, with the exception of vibrocore location VC03A, where exceedances were only observed at the surface.

1.1.9 All of the sampling points from the dredged area provided one or more sample that exceeded the hazardous waste thresholds, therefore the silt as a whole should be dealt with as a hazardous waste.

Table 1.1 Samples observed to exceed hazardous waste thresholds

Hazardous Property	Sample / depth				
	< 1m	< 2m	< 3m	< 4m	< 5m
Very toxic (H6)	x	x	VC04 2m VC08A 2m	VC05 3.48m VC05A 3.78m VC07 3m	VC07 4.87m
Carcinogenic (H7)	VC03A 0m	VC07 1m VC08A 1m	VC04 2m VC05 2m VC07 2m VC08A 2m	VC04 3m VC05 3m VC05 3.48m VC05A 3.78m VC06 3m VC07 3m VC08A 3m	VC04 4m VC06 4.18m VC07 4m VC07 4.87m
Toxic for reproduction (H10)	x	x	x	x	x
Mutagenic (H11)	VC03A 0m	VC07 1m VC08A 1m	VC04 2m VC05 2m VC07 2m VC08A 2m	VC04 3m VC05 3m VC05 3.48m VC05A 3.78m VC06 3m VC08A 3m	VC04 4m VC06 4.18m VC07 4m VC07 4.87m
Ecotoxic (H14)	x	x	VC04 2m VC08A 2m	VC05 3.48m VC07 3m	VC07 4.87m

1.2 Explanation of the Waste Classification Framework

1.2.1 The principles of the hazardous waste classification framework for European Member States, including thresholds and criteria for a number of hazardous properties, was provided in the Hazardous Waste Directive (91/689/EC) and the revised European Waste Catalogue and Hazardous Waste List, which is contained in List Decision (Commission Decision 2000/532/EC as amended). These documents were recently repealed into the revised Waste Framework Directive ('rWFD', 2008/98/EC); however, the principles and approach remain in rWFD.

1.2.2 The rWFD provides a European-wide definition of hazardous waste and requires the correct management and regulation of such waste. Hazardous waste is defined as a waste possessing one or more of the 15 hazardous properties set out in Annex III of the rWFD.

1.2.3 The rWFD also provides for a list of wastes, known as the European Waste Catalogue (EWC), to classify wastes and identify those which are considered to be hazardous because of the hazardous properties set out in Annex III of rWFD. The EWC is a catalogue of all wastes, grouped according to generic industry, process or waste type. It differentiates between non-hazardous and hazardous by identifying hazardous waste entries with an asterisk (*).

1.2.4 The rWFD indicates that the classification of waste as hazardous waste should be based on the European legislation on chemicals. Annex III of the rWFD attributes the 15 hazardous properties by reference to:

- The Dangerous Substances Directive (67/548/EEC), and,
- The Dangerous Preparations Directive (1999/45/EEC)

1.2.5 The EWC links the classification of certain hazardous wastes to the concentrations of "dangerous substances" within the waste and threshold concentrations derived from these directives.

1.2.6 From 1 June 2015, Regulation (EC) No. 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP), **fully** replaces Directives 67/548/EEC and 1999/45/EC. However, it is being implemented in stages leading up to that date with substantial amendments to those Directives.

1.2.7 The UK has implemented the principles of the European hazardous waste regime. The regulatory framework to do this is contained in:

- Hazardous Waste (England and Wales) Regulations 2005 SI 894
- Hazardous Waste (England and Wales) (Amendment) Regulations 2009 SI 507
- List of Wastes (England) Regulations 2005 SI 895
- List of Wastes (England) (Amendment) Regulations 2005 SI 1673

1.2.8 The Hazardous Waste Regulations (as amended) (HWR) have also been recently amended by the Waste (England and Wales) Regulations 2011 SI No. 988. The HWR provide the rules for assessing if a waste is hazardous or not. As part of the assessment of waste, the HWR refer to European Waste Catalogue (EWC) to assign the formal description and code for the waste.

1.3 Guidance

1.3.1 There are two approaches to carrying out a classification assessment of waste:

1. Direct testing for each hazardous property.
2. Desk top assessment.

1.3.2 The desk top method is considered most appropriate for determining the critical hazardous properties. Direct testing is very expensive – furthermore, in the UK for instance, it would not

be permissible to carry out a direct acute toxicological test because the tests involve the use of live animals; ecotoxicological tests also use live aquatic species. Using the principles in the desk top approach, there is no destruction of animal species. Furthermore, direct testing takes a very long time. The desk top approach is, therefore, a proven method of determining hazardous properties that will save money and time over dedicated ecological and toxicological tests.

1.3.3 Guidance on the desk top approach to the waste assessment process is provided by WM2 'Hazardous Waste: Interpretation of the definition and classification of hazardous waste' 3rd Edition (2013). This document is jointly approved by all of the UK environmental regulators and is widely acknowledged as a good practice desk top assessment in the EC. The approach provided in WM2 was followed to deliver the hazardous waste classification assessment in this report (Section 3) and the detailed assessment against each of the hazardous properties, which is provided in Section 2.

1.4 Screening appropriate hazardous properties

1.4.1 There are 15 hazardous properties. WM2 requires that an assessment is made on every hazardous property, but also it allows professional judgement to be applied to screen out the majority of unlikely hazardous properties, based on the type of waste, the degree of contamination and the nature of use of the site.

1.4.2 Other hazardous properties can be dismissed because they relate to physical properties that the waste must exhibit, or because the relevant thresholds or criteria for these hazardous properties are far in exceedance of the levels of contamination found within the sample results.

1.4.3 A summary of the relevant hazardous properties is provided in **Table 1.2** below:

Table 1.2 Relevant hazardous properties

Hazardous Property		Applicability for assessment
H1	Explosive	Not appropriate for silt
H2	Oxidising	Not appropriate for silt
H3	Flammable	Not appropriate for silt
H4	Irritant	High threshold – unlikely that analysis results will exceed threshold
H5	Harmful	High threshold – unlikely that analysis results will exceed threshold
H6	Toxic	Low 'Very toxic' threshold - Appropriate for consideration
H7	Carcinogenic	Appropriate for consideration
H8	Corrosive	High threshold – unlikely that analysis results will exceed threshold
H9	Infectious	Not appropriate for silt
H10	Toxic for Reproduction	Appropriate for consideration
H11	Mutagenic	Appropriate for consideration
H12	Releases toxic or very toxic gases in contact with water, air or an acid	Not appropriate for silt
H13	Sensitising	High threshold – unlikely that analysis results will exceed threshold
H14	Ecotoxic	Appropriate for consideration
H15	Capable by any means, after disposal, of yielding another substance which possesses any of the characteristics listed above	Not appropriate for silt

1.4.4 Detailed justification for the screening of each hazardous property is provided in Section 2.

1.4.5 On this basis, the hazardous properties with the lowest thresholds that are relevant to the substances in the waste are very toxic (hazardous waste property H6), carcinogenic (H7), toxic for reproduction (H10), mutagenic (H11) and ecotoxic (H14).

1.5 Screening appropriate determinands

1.5.1 Certain determinands can be isolated from the assessment process because they do not possess hazardous properties; or are observed to have low concentrations in relation to appropriate hazardous waste thresholds. These can be dismissed from the assessment process.

1.5.2 The priority determinands are as follows:

- Heavy metals.
- Total petroleum hydrocarbons (TPH).
- Polycyclic Aromatic Hydrocarbons (PAH).
- Tin compounds.

1.5.3 The detailed analysis focusses on the presence of these substances and whether their concentrations triggered appropriate hazardous waste thresholds.

1.6 Worst case substances

1.6.1 The hazardous waste methodology requires that the thresholds are based on the concentration of dangerous substances. The laboratory analysis for the heavy metals provides a concentration for each metal, not the metal substance. Invariably, the metal is not present in the waste in its elemental form, but as a metal substance.

1.6.2 To identify whether any of the samples exceed the threshold requires identifying what the worst-case substance is for a particular metal. A worst-case is assumed because the exact nature of the metal substance in the waste is unknown, therefore, a precautionary approach is taken to identify the metal substance with the most hazardous properties.

1.6.3 Professional judgement is used to determine the most likely substance given the likelihood of the chosen worst-case metal substance existing in the environment where the waste is found. For example, if the worst case metal substance is a gas, this will not be appropriate and an alternative worst case substance will be chosen based on the potential to exist where the waste is found.

1.6.4 To convert the results of the metal determinands to their worst-case substance will require an individual multiplication factor to be applied. The conversion factor applied differs for each metal determinand and is based on the proportion of the atomic weight of the metal in the molecular weight of the worst case substance.

1.6.5 As an example the worst-case copper substance is assumed to be copper (I) oxide Cu_2O. The molecular weight of the substance is 143 and the atomic weight of copper is 63.5. So, as there are two atoms of copper per molecule, the conversion factor is 143 ÷ (63.5 x 2) = 1.126.

1.6.6 The conversion factors used for each metal determinand to worst case metal substance are show in **Table 1.3.**

Table 1.3 Worst case substance conversion factors

Metal	Worst case compound	Worst case conversion factor
Arsenic	Arsenic pentoxide	1.533
Cadmium	Cadmium oxide	1.143
Chromium	Chromium (VI) oxide	1.923
Copper	Copper (I) oxide	1.126
Lead	Lead sulphate	1.464
Mercury	Mercury oxide	1.08
Nickel	Nickel carbonate	2.017
Zinc	Zinc oxide	1.246

1.6.7 The worst-case substances used in the assessment are provided above; and used in the 'Waste Classification Assessment Calculation' (which is provided in Section 3). Note that PAHs, TPH and tin compounds are substances and, therefore, a worst case assessment is not required for these results.

1.6.8 The list can be amended as necessary to fit local specific site circumstances and/or in the context of knowledge about the geological conditions of the local area or region. Worst case substances should always be used in the hazardous waste assessment method unless it can be proven that a more suitable substance exists within the waste material.

1.7 Thresholds for appropriate hazardous properties

Very toxic (H6) assessment

1.7.1 The very toxic threshold is 1000mg/kg and applies to the total concentration of very toxic substances in the waste.

1.7.2 The very toxic determinands are dibutyltin, chromium (worst case substance), cadmium (worst case substance) and mercury (worst case substance). The sum of the concentrations of these substances is compared to the threshold.

Carcinogenic (H7) assessment

1.7.3 The generic carcinogenic threshold is 1000 mg/kg and applies to single substances only; it is not an accumulation of all carcinogenic substances – this is because carcinogenic substances can have a markedly different effect from each other.

1.7.4 The assessment process considers both carcinogenic inorganic compounds and carcinogenic organic compounds. Where applicable, asbestos is also considered as this is also carcinogenic.

Carcinogenic metal substances:

1.7.5 The carcinogenic metal substances (based on worst case substance concentration) are Arsenic, Cadmium, Chromium and Nickel.

1.7.6 The waste would be demonstrated as possessing hazard H7 – Carcinogenic if any one of these worst-case metal substances has a concentration of 1000mg/kg or more.

Carcinogenic organic substances:

1.7.7 Petroleum hydrocarbons are complex mixtures of many individual substances. Many petroleum products have been identified as carcinogens. However, where the specific hydrocarbon product is not known, an assessment of carcinogenicity is made using the Total Petroleum Hydrocarbon (TPH) concentration. If the concentration of TPH is less than 1000 mg/kg, the threshold is not exceeded and the waste will not be considered carcinogenic, unless another carcinogen is present at or above the threshold.

1.7.8 If the TPH concentration is ≥1000 mg/kg, the advice provided in WM2 Appendix A, Example 3 will apply, which requires the use of a 'marker substance' benzo[a]pyrene ('b[a]p'), which is one of the PAH determinands. This process involves calculating the ratio of the b[a]p concentration to the TPH concentration. If the ratio (1 in 10,000, or 0.0001) is exceeded, the TPH is considered to be carcinogenic. Therefore, where the TPH value is 1000 mg/kg or more and the b[a]p/TPH ratio is >0.0001, the waste will be considered to possess H7.

Toxic for reproduction (H10) assessment

1.7.9 Benzo[a]pyrene, dibutyltin, the worst case lead substance and the worst case nickel substance are classified as toxic for reproduction (H10). This classification means these substances are generally considered to induce non-hereditary congenital malformations or increase their incidence if they are inhaled or ingested or if they penetrate the skin, unless data for a specific lead substance demonstrates otherwise.

1.7.10 The lowest threshold for this hazardous property is 5000 mg/kg. This is based on a single substance only, there is no addition with any other substance.

Mutagenic (H11) Assessment

1.7.11 Benzo[a]pyrene and the worst case chromium substance are classified as category 2 mutagens and are considered against the Mutagenic (H11) hazardous property.

1.7.12 The advice provided in WM2 Appendix A, Example 3 identifies that if a waste possesses hazardous property H7 as a consequence of the TPH concentration, using the b[a]p/TPH ratio, it will also possess hazardous property H11.

Ecotoxic (H14) assessment

1.7.13 This has a complex assessment process because there are different generic thresholds according to the degree of toxicity and how persistent the substance is in the aquatic environment and because there are complex ways in which different substances of varying toxicity and persistence can be combined to compare against the generic thresholds; and because certain persistent organic pollutants have substance-specific thresholds that can be several orders of magnitude lower than the generic threshold.

1.7.14 Most heavy metal substances are very toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment. Some PAHs and organo-tin compounds also have the same ecotoxic effect.

1.7.15 WM2 identifies the hazardous waste thresholds. The generic threshold for substances that are classified as 'very toxic to the aquatic organisms and may cause long-term adverse effects in the aquatic environment' is 2500 mg/kg. This is the lowest 'generic threshold'. This threshold applies to the total concentration of all substances in the waste that are classified as 'very toxic to the aquatic organisms and may cause long-term adverse effects in the aquatic environment'. So the concentration of each individual ecotoxic substance in the waste must be added together to determine if the threshold is met or exceeded.

1.7.16 The assessment methodology identified for ecotoxicity in Chapter 14 of Appendix C of WM2 identifies that certain persistent organic pollutants have a substance-specific ecotoxicity threshold, which is different to the generic threshold mentioned in the above paragraph. The main point of reference for dangerous substance classification data is Table 3.2 of Annex VI of the CLP Regulation - European Regulation (1272 / 2008) on the classification, labelling and packaging of chemicals which was adopted by Europe on December 2008 (the CLP Regulation). CLP Table 3.2 must be used to identify the substance specific thresholds for ecotoxicity.

1.7.17 Two PAH substances have ecotoxic substance specific thresholds. These are Benzo(a)anthracene and Dibenzo(a,h)anthracene, which both have a specific ecotoxic threshold of 25 mg/kg. Therefore, if the concentration of these substances exceeds 25 mg/kg, the waste it is deemed to possess H14 – ecotoxicity, and will be classified as hazardous. Dibutyltin and tributyltin also have a specific threshold, which is 250 mg/kg.

1.7.18 The following steps are then required to carry out the ecotoxic assessment:

1. Calculate the worst-case concentration for the heavy metal analysis results and group all substances according to their risk phrases (i.e. R50-53, R51-53 or R50 etc. – see WM2 Appendix C Chapter 14).

2. Identify if any one substance is present at the generic threshold level (2500 mg/kg) or greater. If yes, the waste is ecotoxic; otherwise, proceed to the next step

3. Identify whether there is a substance present which has a substance specific concentration threshold for an aquatic risk phrase in CLP Table 3.2. If yes, the waste is ecotoxic if that concentration threshold is exceeded; otherwise, proceed to the next step

4. WM2 section C14.3 identifies that substances present at <1000mg/kg (based on the worst case concentration) can be excluded from the calculation. Screen out all of these 'trace impurity compounds'.

5. Add together all of the remaining substances which have the same classification (i.e. 'very toxic to the aquatic organisms and may cause long-term adverse effects in the aquatic environment'). Identify whether any of the generic thresholds are exceeded. If yes, the waste is ecotoxic, otherwise, proceed to the next step.

6. Apply WM2 Appendix C14 equation 1 (See Annex 2 or WM2 Table C14.2). If the total is greater than 1 the waste is ecotoxic, otherwise, proceed to the next step.

Note: the next steps have very high thresholds. It is unlikely that any determinand will be present at concentrations which will cause the thresholds in the following steps to be exceeded, however, they are repeated below for completeness.

7. Apply WM2 Appendix C14 equation 2 (See Annex 2 or WM2 Table C14.3). If the total is greater than 25 the waste is ecotoxic, otherwise, proceed to the next step.

8. Apply WM2 Appendix C14 equation 3 (See Annex 2 or WM2 Table C14.4). If the total is greater than 25 the waste is ecotoxic, otherwise, proceed to the next step.

9. Apply WM2 Appendix C14 equation 4 (See Annex 2 or WM2 Table C14.5). If the total is greater than 25 the waste is ecotoxic, otherwise the waste is not ecotoxic and the H14 assessment.

1.8 Assessment of results

1.8.1 The analysis results reported in report J-2646 (dated 04/09/2014) were assessed to identify whether any samples could be considered to be hazardous waste or not. The outcome of the assessment is presented in Section 3.

1.8.2 A summary of the results is presented in **Table 1.1**.

Very toxic (H6) assessment

1.8.3 Elevated chromium results were observed in the data. As a consequence of this, six samples were observed to exceed the hazardous waste threshold for Very Toxic – H6. These were: VC04 2m; VC08A 2m; VC05 3.48m; VC07 3m; VC07 4.87m; and VC05A 3.78m.

Carcinogenic (H7) assessment

1.8.4 A total of 18 samples were observed to exceed the threshold for Carcinogenic H7.

Carcinogenic metal substances:

1.8.5 As a consequence of the elevated chromium, the samples VC04 2m; VC08A 2m; VC05 3.48m; VC07 3m; VC07 4.87m; and VC05A 3.78m exceeded the threshold for Carcinogenic H7 on the basis of heavy metal concentration.

Carcinogenic organic substances:

1.8.6 In accordance with the criteria identified in WM2 example 3, 17 of the 38 samples were observed to exceed the Carcinogenic H7 threshold on the basis of hydrocarbon concentration. This includes five of the six samples referenced above (the exception being VC07 3m).

Toxic for reproduction (H10) assessment

1.8.7 No samples were observed to exceed the Toxic for reproduction hazardous waste threshold.

Mutagenic (H11) Assessment

1.8.8 As a consequence of the elevated chromium, the samples VC04 2m; VC08A 2m; VC05 3.48m; VC07 3m; VC07 4.87m; and VC05A 3.78m exceeded the threshold for Mutagenic H11 on the basis of chromium concentration.

1.8.9 In accordance with the criteria identified in WM2 example 3, 17 of the 38 samples were observed to exceed the Mutagenic (H11) threshold on the basis of hydrocarbon concentration.

Ecotoxic (H14) assessment

1.8.10 The assessment process identified that as a consequence of elevated chromium, copper and zinc, five samples possess the hazardous property Ecotoxic H14: VC04 2m; VC08A 2m; VC05 3.48m; VC07 3m and VC07 4.8m.

2 DETAILED REVIEW OF HAZARDOUS PROPERTIES

2.1 Hazardous properties

2.1.1 The full list of hazardous properties is provided below in **Table 2.1**:

Table 2.1 Hazardous Properties

Hazardous Property		Definition
H1	Explosive	"Explosive": substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene.
H2	Oxidising	"Oxidising": substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances.
H3a	Highly Flammable	Highly flammable H3a - liquid substances and preparations having a flashpoint of below 21°C (including extremely flammable liquids); or - substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy; or - solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition; or - gaseous substances and preparations which are flammable in air at normal pressure; or - substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.
H3b	Flammable	"Flammable": liquid substances and preparations having a flashpoint equal to or greater than 21°C and less than or equal to 55°C
H4	Irritant	"Irritant": non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.
H5	Harmful	"Harmful": substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks.
H6	Toxic	"Toxic": substances and preparations (including very toxic substances and preparations) which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death.
H7	Carcinogenic	"Carcinogenic": substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence.
H8	Corrosive	"Corrosive": substances and preparations which may destroy living tissue on contact.
H9	Infectious	"Infectious": substances containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or other living organisms.

H10	Toxic for Reproduction	“Toxic for reproduction”: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce non-heritable congenital malformations or increase their incidence.
H11	Mutagenic	“Mutagenic”: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce hereditary genetic defects or increase their incidence.
H12	Releases toxic or very toxic gases	Substances and preparations which release toxic or very toxic gases in contact with water, air or an acid.
H13	Sensitising	“Sensitizing”: substances and preparations which, if they are inhaled or if they penetrate the skin, are capable of eliciting a reaction of hypersensitisation such that on further exposure to the substance or preparation, characteristic adverse effects are produced. [As far as testing methods are available].
H14	Ecotoxic	“Ecotoxic”: substances and preparations which present or may present immediate or delayed risks for one or more sectors of the environment
H15	Capable of disposal hazard	Substances and preparations capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics listed above.

2.1.2 Each of these hazards is discussed in turn to provide further guidance on why the initial assessment screening has justified inclusion or exclusion from the assessment process.

2.1.3 It is noted that Article 2 of the List of Waste Decision (2000/532/EC as amended), which has now been incorporated into the revised Waste Framework Directive (2008/98/EC) only sets out legislative thresholds for hazardous properties H3-A(first indent), H3-B, H4 to H8, H10 and H11. These thresholds are provided in the Hazardous Waste Regulations 2005 (as amended).

2.1.4 Threshold concentrations for the hazardous properties not covered by Article 2 (that is H1, H2, H3-A (second to fifth indents), H12, H13, H14 and H15), have been developed based on the classification and risk phrases according to European legislation on chemicals (Regulation (EC) No. 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP)) and have formed the cornerstone of the assessment process, which is outlined in WM2. The thresholds for some of these hazards can be calculated, while others require testing of physical properties.

2.2 H1 Explosive

2.2.1 The hazardous property applies to the waste as a whole, i.e. the waste silt would need to be considered as an explosive for the hazardous property to apply.

2.2.2 There is no threshold for hazard H1 set in the List Decision 2000/532/EC as amended. Therefore, the criteria for assessment of this hazard is based on guidance; or the use of the appropriate test methods, which are described in *Council Regulation (EC) 440/2008 laying down test methods pursuant to Regulation (EC) No 1907/2006 of the European Parliament and*

of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (known as the 'Test methods for REACH'). Tests for explosive can be found in Section A14: Explosive Properties. The approach in WM2 is to take a worst-case desk top approach and assume that if the waste possesses any substance that presents a risk, or extreme risk of explosion by shock, friction, fire or other sources of ignition, then the waste is considered explosive, unless test methods (carried out in accordance with Section A14) demonstrate that the waste as a whole is not explosive.

2.2.3 The material is not likely to possess any of the characteristics that are likely to cause it to be explosive, given it has existed in a marine environment. There has been no indication of any site history that would give rise to suspect contamination by explosive substances at concentrations that would render the silt explosive. On this basis, the assessment against H1 can be excluded.

2.2.4 This assessment is based on the likelihood of contamination of substances that are classified as explosive or having explosive properties. If there is any unexploded ordinance within the silt when is dredged, this would be considered as a separate article on its own merits, rather than as a contaminant of the silt; and would be isolated and each item of unexploded ordinance would be dealt with in accordance with the appropriate National laws.

2.2.5 In terms of the actual analysis, the desk top presumption of exclusion of H1 is confirmed by the fact that there are no specific explosive substances within the silt at concentrations that give cause for concern in report J-2646 (dated 04/09/2014).

2.2.6 Therefore, H1 is considered not appropriate for inclusion in the assessment of the silt.

2.3 H2 Oxidising

2.3.1 There is no threshold set for hazard H2 in the List Decision 2000/532/EC as amended. Therefore, the criteria for assessment of this hazard is based on guidance; or the use of the appropriate methods, which are described in Test methods for REACH, Section A.17 and A.21. In the absence of testing, WM2 provides concentration limits for groups of substances that may be considered to be strong oxidisers. These thresholds can be over-ridden if a substance has a specific concentration threshold set according to Annex VI, Table 3.2 to the Classification, Labelling and Packaging of Substances Regulation ('CLP Table 3.2'). Therefore, WM2 identifies that the hierarchy for deciding on threshold limiting concentrations should be as follows:

- substances listed in CLP table 3.2 with specific concentration limits;
- organic peroxides, for which concentration limits may be calculated;
- inorganic and other oxidisers, for which testing is the only option.

2.3.2 There has been no indication of any site history that would give rise to suspect contamination by oxidising substances at concentrations that would render the silt to be considered to be an

oxidiser. Given that the silt has been in a marine environment for considerable time, the likelihood of there being any substances present that to justify that the silt is considered to be an oxidiser is negligible. Therefore, professional judgement confirms that further testing is not required. On this basis, the assessment against H2 can be excluded.

2.3.3 It is also noted that the report J-2646 (dated 04/09/2014) did not identify any substance that is classed as an oxidiser with a specific concentration limit in CLP Table 3.2 present at, or above the specific concentration limit.

2.4 H3a and H3b Highly Flammable/Flammable

2.4.1 For either of these hazardous properties to apply, the material would need to meet the criteria identified in **Table 2.1**.

- H3a first indent or H3b cannot apply because the silt is not a liquid.
- H3a 2nd and 3rd indent will not apply because the silt largely consists of inert material. There is no evidence from the analysis data that there is significant presence of other substances that give concern that the silt contains substances that could cause the silt to catch fire in contact with air or other sources of ignition.
- H3a 4th indent cannot apply because the silt is not a gas.
- H3a 5th indent will not apply because the silt has already been in contact with water and there is no evidence of the evolution of highly flammable gasses in the Port as a consequence of the presence of the silt.

2.4.2 On this basis, the assessment against H3a or H3b can be excluded.

2.5 H4 Irritant

2.5.1 Article 2 of the List of Waste Decision (2000/532/EC as amended) sets a threshold of 20% w/w for the total concentration of substances that are classified as irritant in the waste; with a lower threshold for substances that cause serious damage to eye tissue, where the threshold is 10%.

2.5.2 Note: The mechanical irritation produced by some substances, for example mineral wool, is not included within the definition of H4.

2.5.3 Therefore, for the waste to be classified as hazardous, either:

- the total combined concentrations of all substances that are classified as irritant, would have to be 20% or more, i.e.≥ 200,000 mg/kg; or
- the total combined concentrations of all substances that are classified as ‘causing serious damage to eye tissue’, would have to exceed 10% i.e.≥ 100,000 mg/kg.

2.5.4 The majority of the silt would be inert or naturally-occurring material. The analysis report J-2646 (dated 04/09/2014) does not identify any dangerous substances at concentrations that would

merit assessment against hazardous property H4. It is on this basis that this hazardous property was excluded from the scope of analysis. Therefore, the analytical findings support the generic exclusion.

2.6 H5 Harmful

2.6.1 "Harmful" has a specified concentration limit set out in 2000/532/EC (as amended), which is one or more substances classified as harmful at a total concentration ≥ 25% (250,000 mg/kg). Therefore, the total combined concentrations of all substances that are classified as harmful would have to exceed 25% for the waste to be hazardous by H5.

2.6.2 Given the threshold, it is considered unlikely that a single harmful substance or a combination of harmful substances in the waste will exceed 25%, given that the bulk of the silt is considered to be an inert, natural mineral based material. The level of contamination would have to be extensive for one quarter of the silt to be a harmful substance.

2.6.3 The analysis report J-2646 (dated 04/09/2014) does not identify any dangerous substances at concentrations that would merit assessment against hazardous property H5. It is on this basis that this hazardous property was excluded from the scope of analysis. Therefore, the analytical findings support the generic exclusion.

2.7 H6 Toxic

2.7.1 The hazardous property "Toxic" has two specified concentration limits in 2000/532/EC (as amended), which are distinguished according to the classification of any potential contaminating substances classified as either 'toxic' or 'very toxic'. The thresholds are:

- one or more substances classified as very toxic at a total concentration ≥ 0.1%;
- one or more substances classified as toxic at a total concentration ≥ 3%

2.7.2 The assessment of the silt against the very toxic threshold has been carried out on the silt – see section 1.8.3. The conclusion was that the very toxic threshold was exceeded by six samples.

2.7.3 The second threshold would apply where the total concentration of substances classified as toxic (excluding any classified as 'very toxic') is 3% or more (i.e. ≥ 30,000 mg/kg). In terms of notable heavy metals, only arsenic is classified as toxic. There are a large number of substances that are classified as toxic, particularly organic substances, however, the analysis report J-2646 (dated 04/09/2014) shows that that the cumulative total of such substances does not exceed 30,000 mg/kg. It is on this basis that this hazardous property was excluded from the scope of analysis. Therefore, the analytical findings support the generic exclusion.

2.8 H7 Carcinogenic

Organic carcinogens

2.8.1 The assessment considered substances that are, or potentially are, classified as Category 1 or Category 2 carcinogens. The hazardous waste threshold is provided in 2000/532/EC (as amended) is 0.1% (1000 mg/kg); and this applies to individual substances, i.e. different substances that are classified as Category 1 or Category 2 substances are not added together, because different carcinogens have different carcinogenic effects.

2.8.2 The assessment for organic substances is a complex process, particularly where is concerns oils and other hydrocarbons.

2.8.3 Oil is considered to be a dangerous substance. This presumption is made given the fact that all waste oils are considered to be hazardous by the European Commission. Oils are complex mixtures or preparations that comprise many different substances, therefore, it can be very difficult to interpret certain hazardous properties on this basis. Evidence has been provided by the UK's Health and Safety Executive that used oils, for example, used engine oil, are considered to be carcinogenic. This is also reflected by the number of petrochemical substances listed on CLP Table 3.2 that are classified as carcinogens.

2.8.4 Unless there is knowledge about any specific oils that may have caused contamination, the exact nature of any oil or hydrocarbon is almost certainly not going to be known. In such circumstances, an approach has been taken to assess whether the Total Petroleum Hydrocarbon (TPH) concentration exceeds the category 1 and 2 threshold of 1000 mg/kg.

2.8.5 The TPH represents all of the aliphatic and aromatic hydrocarbons with a carbon chain length between 5 and 44. If the total petroleum hydrocarbon (TPH) concentration is less than 1000mg/kg, the waste silt would not be considered carcinogenic due to hydrocarbons.

2.8.6 To simplify the complexity of the assessment process for waste oils and substances that may be contaminated with waste oils or other hydrocarbons for the purpose of assessment against the carcinogenic hazardous waste threshold, there is a specific worked example in WM2 to demonstrate the assessment process – see WM2 Appendix A, Example 3.

2.8.7 WM2 Appendix A, Example 3 identifies that where the TPH concentration is ≥ 1000mg/kg a further test can be carried out to assess whether the TPH in the waste is considered to be a carcinogen. This is done by calculating the concentration of a 'marker' carcinogenic polycyclic aromatic hydrocarbons (PAHs) within the TPH in the waste. Several PAHs are carcinogenic, and that these generally give oil carcinogenic properties. The PAH used as a carcinogenic marker is benzo[a]pyrene ('b[a]p').

2.8.8 The concentration of b[a]p' is compared to the TPH total. Where the TPH is 1000mg/kg or more AND the concentration of b[a]p' to TPH is 1 in 10,000 or more (i.e. ≥ 0.0001), the waste will considered to be hazardous by H7.

2.8.9 The assessment of the silt against the carcinogenic threshold has been carried out on the silt in accordance with WM2 Appendix A, Example 3– see section 1.8.4 to 1.8.6. Several samples were observed to possess H7 on the basis of TPH concentration.

2.8.10 There is a further threshold for Category 3 Carcinogens set in 2000/532/EC (as amended). The threshold is 1% (or 10,000 mg/kg). Fuel oil and diesel is a category 3 carcinogen, so where there is site specific information to suggest that there has been a fuel oil or diesel spill; or that hydrocarbon contamination is based on fuel oil and / or diesel contamination, the assessment against the category 3 threshold would be applied. Although a proportion of the Total Petroleum Hydrocarbons (TPH) observed in the analysis report J-2646 (dated 04/09/2014) is likely to be attributable to fuel oil and / or diesel from vessels; there is no evidence to suggest that the TPH is exclusively from fuel oil and / or diesel. The TPH data has not been separated according to speciated hydrocarbon ranges; nor is there any chromatographic data provided that could be used to compare fuel oil and / or diesel chromatographic profiles. Therefore, the assessment against the category 3 threshold was excluded on this basis, and the conservative assessment assumption against a carcinogenic category 1 or 2 substance was adopted for TPH.

Inorganic carcinogens

2.8.11 The thresholds identified in 2.8.1 apply to individual inorganic substance that are classified as category 1 or category 2 carcinogens. There is no additional assessment involving the use of marker substances.

2.8.12 As a consequence of elevated chromium (chromium VI substances are category 2 carcinogens), a number of samples were observed to be classified as H7 as a consequence of the presence of inorganic carcinogens (see 1.8.5).

2.9 H8 Corrosive

2.9.1 “Corrosive” has a specified concentration limit set out in 2000/532/EC (as amended), which is: one or more substances classified as corrosive at a total concentration ≥ 1% (or 10,000 mg/kg). The assessment process has screened this out on the basis that the threshold is normally too high for common contaminants of marine silt; and because the silt is in an aquatic environment, which would dilute any corrosive substance. Therefore it is not expected that corrosive substances would exist in the silt at concentrations that would trigger the threshold.

2.9.2 The analysis report J-2646 (dated 04/09/2014) does not identify any dangerous substances at concentrations that would merit assessment against hazardous property H8. It is on this basis that this hazardous property was excluded from the scope of analysis.

2.10 H9 Infectious

2.10.1 The assessment process for H9 Infectious is divided between healthcare wastes, which have a much higher likelihood of containing infectious agents; and non-healthcare wastes.

2.10.2 For non-healthcare wastes, the assessment against H9 is carried out where there is specific knowledge that the waste is or highly likely to be contaminated with a microbial agent that can cause infection. That specific knowledge would have to demonstrate that the micro-organism was present above naturally encountered levels and that it can cause disease in man or other living animal. For example, it may be necessary to apply this assessment to silt from standing water, for example where suspected blue-green algae colonies; or other cyano-bacterial bloom, has occurred.

2.10.3 In almost all cases, H9 assessment will not apply to silt from an estuarine location. On this basis, the assessment of the silt excluded an assessment against H9.

2.11 H10 Toxic for Reproduction

2000/532/EC as amended) sets out the following thresholds for hazardous property H10:

- Category 1 or 2 substances – the threshold for individual substances is 0.5% (w/w) (or 5000 mg/kg).
- Category 3 substances - the threshold for individual substances is 5% (w/w) (or 50,000 mg/kg).

An assessment against H10 has been carried out – see 1.8.7. It was concluded that none of the substances that are classified as toxic for reproduction were present at or above the relevant threshold.

2.12 H11 Mutagenic

2.12.1 2000/532/EC as amended) sets out the following thresholds for hazardous property H11:

- Category 1 or 2 substances – the threshold for individual substances is 0.1% (w/w) (or 1000 mg/kg).
- Category 3 substances - the threshold for individual substances is 1% (w/w) (or 10,000 mg/kg).

2.12.2 The main substances of concern are chromium (worst-case compound) and b[a]p, which are classified as a category 2 mutagens. TPH is also included in the assessment -see 1.7.12. It is noted that the worst-case cadmium compound, the worst-case nickel compound and chrysene are classified as category 3 mutagens. These have been screened out because the analysis report J-2646 (dated 04/09/2014) does not identify any category 3 mutagenic substances at concentrations that would merit assessment against hazardous property H11. Therefore, the analysis focussed on category 2 carcinogens only.

2.12.3 The assessment was carried out on this basis, see 1.8.8 and 1.8.9 and a number of samples were observed to exceed the threshold.

2.13 H12 – Contact with Air Water or Acid Liberates a Toxic Gas

2.13.1 There is no threshold provided for H12 in 2000/532/EC as amended. Therefore, guidance is used. The assessment against this hazard requires that there are highly reactive substances in the waste that evolve toxic gas in contact with water, air or an acid.

2.13.2 This hazard is excluded on the basis that the marine silt is highly unlikely to contain any substance that will cause a toxic gas to be liberated in contact with air or an acid. Note that water has been discounted because the silt was in an aquatic environment.

2.14 H13 Sensitising

2.14.1 There is no threshold provided for H12 in 2000/532/EC as amended. Therefore, guidance is used. The assessment against this hazard is provided in WM2 and it requires that, for solid wastes, the threshold is 1% (or 10,000 mg/kg) and this is based on an individual substance. The substances that are considered to be sensitising are: nickel (worst case compound), chromium (worst case compound) and benzo[a]pyrene.

2.14.2 On the basis that the analysis report J-2646 (dated 04/09/2014) shows that none of the above substances were present at concentrations close to the threshold, this hazard was excluded.

2.15 H14 Ecotoxic

2.15.1 The alternative to the desk-top assessment is to carry out ecotoxicity tests. These are to be discouraged because:

1. Testing for the evaluation of the ecotoxicity must be carried out on all three aquatic species (algae, daphnia, fish), in compliance with the criteria of the Test methods for REACH. A waste can only be determined to be non-hazardous by Ecotoxic if all three species have been tested. A positive (Ecotoxic) test result for a single species would however negate the need for testing on the other two.

2. These test methods may have limitations when applied to partially soluble or insoluble wastes that could require fundamental alterations to test methodology. This will reduce the value of the results obtained.

3. Testing on fish is a ‘regulated procedure’ that uses a ‘protected animal’ and falls within the scope of the Animals (Scientific Procedures) Act 1986 (as amended) in the UK. Regulated procedures can only be authorised and performed if there are no scientifically suitable alternatives that

- replace animal use,
- reduce the number of animals needed, or
- refine the procedures used to cause suffering.

2.15.2 In addition the likely benefits (to humans, other animals or the environment) must be weighed against the likely welfare costs to the animal involved. So, testing a waste to identify whether it possesses H14 can only be considered where it can be demonstrated that there is no other alternative to animal testing.

2.15.3 The desk-top assessment against H14 is extremely complex, because there are different categories of dangerous to the environment, which each have different thresholds, which may, or may not be combined in different ways to determine whether a waste possesses.

There are generic thresholds for each category of ecotoxicity (0.25% for very toxic to the aquatic environment; 2.5% for toxic to the aquatic environment; and 25% for harmful to the aquatic environment, which are also often in conjunction with the persistence of the substance in the aquatic environment). Furthermore, CLP Table 3.2 can assign certain specific substances with a specific concentration threshold. WM2 advises that for such substances, the lowest concentration set by CLP Table 3.2 will be the hazardous waste threshold.

2.15.4 A waste may exhibit the hazard H14 if it contains a substance or substances assigned any of the following “ecotoxic” risk phrases:

- R50 Very toxic to aquatic organisms
- R51 Toxic to aquatic organisms
- R52 Harmful to aquatic organisms
- R53 May cause long-term effects in the aquatic environment
- R59 Dangerous for the ozone layer

2.15.5 The aquatic risk phrases R50 to R53 can be found on their own or in combination with other risk phrases, for example:

- R50-53 Very toxic to aquatic organisms and may cause long-term effects in the aquatic environment
- R51-53 Toxic to aquatic organisms and may cause long-term effects in the aquatic environment
- R52-53 Harmful to aquatic organisms and may cause long-term effects in the aquatic environment

2.15.6 In the case of ecotoxicity, the joint risk phrases have a distinct function and meaning; R50-53 in particular has specific threshold values.

2.15.7 The process of assessment against H14 requires sorting the determinands into their category of ecotoxicity, and identifying whether there are any with specific concentration thresholds. If the generic or specific concentrations are not exceeded, then a calculation method is applied to each ecotoxic category in the particular combinations, which are defined by the equations below. These equations have a priority order as follows:

Equation 1: A waste is dangerous for the environment (H14 Ecotoxic) if:-

$$\Sigma \left(\frac{P_{N.\,R50\text{-}53}}{0.25} + \frac{P_{N.\,R51\text{-}53}}{2.5} + \frac{P_{N.\,R52\text{-}53}}{25} \right) \geq 1$$

Where:-

- Σ is the sum total of the (……)
- $P_{N.\,R50\text{-}53}$ is the total concentration of dangerous substances classified as R50-53
- $P_{N.\,R51\text{-}53}$ is the total concentration of dangerous substances classified as R51-53
- $P_{N.\,R52\text{-}53}$ is the total concentration of the dangerous substances classified as R52-53
- Concentrations are expressed as w/w percent.

Equation 2 : A waste is dangerous for the environment (H14 Ecotoxic if:-

$$\Sigma \left(P_{N.\,R50} + P_{N.\,R50\text{-}53}\right) \geq 25\%$$

Where

- Σ is the sum total of the (……)
- $P_{N.\,R50}$ is the total concentration of dangerous substances classified as R50
- $P_{N.\,R50\text{-}53}$ is the total concentration of dangerous substances classified as R50-53
- Concentrations are expressed as w/w percent.

Equation 3: A waste is dangerous for the environment if:-

$$\Sigma \left(P_{N.\,R52}\right) \geq 25\%$$

Where

- Σ is the sum total of the (……)
- $P_{N.\,R50}$ is the total concentration of the dangerous substances classified as R52
- Concentrations are expressed as w/w percent.

And finally

Equation 4 A waste is dangerous for the environment if:-

$$\Sigma \left(P_{N.\,R53} + P_{N.\,R50\text{-}53} + P_{N.\,R51\text{-}53} + P_{N.\,R52\text{-}53} \right) \geq 25\%$$

Where

- Σ is the sum total of the (……)
- $P_{N.\,R53}$ is the total concentration of the dangerous substances classified as R53
- $P_{N.\,R50\text{-}53}$ is the total concentration of the dangerous substances classified as R50-53
- $P_{N.\,R51\text{-}53}$ is the total concentration of the dangerous substances classified as R51-53
- $P_{N.\,R52\text{-}53}$ is the total concentration of the dangerous substances classified as R52-53
- Concentrations are expressed as w/w percent.

If the result of Equation 4 indicates that the waste is Ecotoxic the assessment ends here.

2.15.8 In normal circumstances, it is not required to go beyond equation 1 because of the high thresholds for the other categories of ecotoxicity.

2.15.9 A comprehensive assessment against H14 has already been carried out – see 1.8.10 above.

2.16 H15 Capable of Yielding a Hazardous Property after Disposal

2.16.1 There is no threshold provided for H15 in 2000/532/EC as amended. Therefore, guidance is used. The assessment against this hazard requires that the waste possesses a substance that when disposed would give rise to the waste subsequently possessing one of the hazards H1 to H14.

2.16.2 This hazardous property only applies if the waste contains substances that degrade to form; (or react with) other wastes or substances to produce; (or produce on combustion) other substances with any of the properties H1 to H14, at or above the appropriate threshold concentrations.

2.16.3 WM2 identifies the likely effects that contaminating substances are required to possess in order for H15 to be considered:

2.16.4 H15 may arise from reaction with a substance which is already allocated a risk phrase, or a substance may be produced which may be allocated a risk phrase. Most risk phrases are assigned to hazards already and would have been considered in the assessment of H1 to H14, so the likelihood of a hazard H15 arising by this route is negligible. However, there are a number of unassigned or associated risk phrases which may cause hazard H15 to arise. The most likely are:

- R1 Explosive when dry
- R4 Forms very sensitive explosive metal compounds
- R5 Heating may cause explosion
- R6 Explosive with or without contact with air
- R16 Explosive when mixed with oxidising material
- R18 In use may form flammable/explosive vapour-air mixture
- R19 May form explosive peroxides
- R44 Risk of explosion if heated under confinement

2.16.5 This hazard is excluded on the basis that the marine silt is highly unlikely to contain any substance that will yield any hazard not previously encountered, when it is stored and de-watered pending use, or if it is used. Any substance likely to do this would have already been discovered during the assessment of H1 to H14.

[Blank Page]

3 WASTE CLASSIFICATION ASSESSMENT CALCULATION

[Blank Page]

Summary of Chemical Analysis
Soil
Our Ref: 9Y0989-109-101

Screening for general hazardous properties.

The waste classification assessment is undertaken in accordance with the Hazardous Waste Regulations and the List of Waste Regulations, using guidance provided by the regulator (WM2 Interpretation of the definition and classification of hazardous waste').
The assessment in the regulations requires that all hazards must be assessed to determine whether the excavated material will possess any hazardous properties.

However, WM2 provides a desktop assessment approach that allows certain hazardous properties to be excluded on the basis that analytical evidence and/or site history indicates that they are unlikely to be present in excavated material.

The key properties with the lowest threshold are very toxic (H6 certain heavy metals and organics), carcinogenic (H7 TPH and PAH), toxic for reproduction (H10 for lead) and ecotoxic (H14, PAH and heavy metals).
Unless other evidence to the contrary is presented, it is assumed that these are the target hazards requiring assessment at the site.

Hazard Definitions

H1	Explosive	Not appropriate for a soil
H2	Oxidising	Not appropriate for a soil
H3a	Highly Flammable	Not appropriate for a soil
H3b	Flammable	Not appropriate for a soil
H4	Irritant	Higher threshold hazard
H5	Harmful	Higher threshold hazard
H6	Toxic	Very toxic threshold may be relevant
H7	Carcinogenic	Appropriate for consideration
H8	Corrosive	Higher threshold hazard
H9	Infectious	Not appropriate for a soil
H10	Toxic for Reproduction	Appropriate for consideration
H11	Mutagenic	Appropriate for consideration if the material contains oil and is assessed to possess H7
H12	Releases toxic or very toxic gases in contact with water, air or an acid	Not appropriate for a soil
H13	Sensitising	Higher threshold hazard
H14	Excotoxic	Appropriate for consideration
H15	Capable by any means, after disposal, of yieling another substance which posesses any of the characteristics listed above	Higher threshold hazard

Results are based on the solid soil analyses, which have been taken from the reports referenced in row 4 above.

The hazardous waste assessment is based on worst-case substances. The analysis results for the heavy metals are presented as the metal determinand.
Therefore, a conversion factor is required to convert the metal analysis result into to the worst-case metal substance result.
Analysis results for non-metal species do not require a factor to be applied.

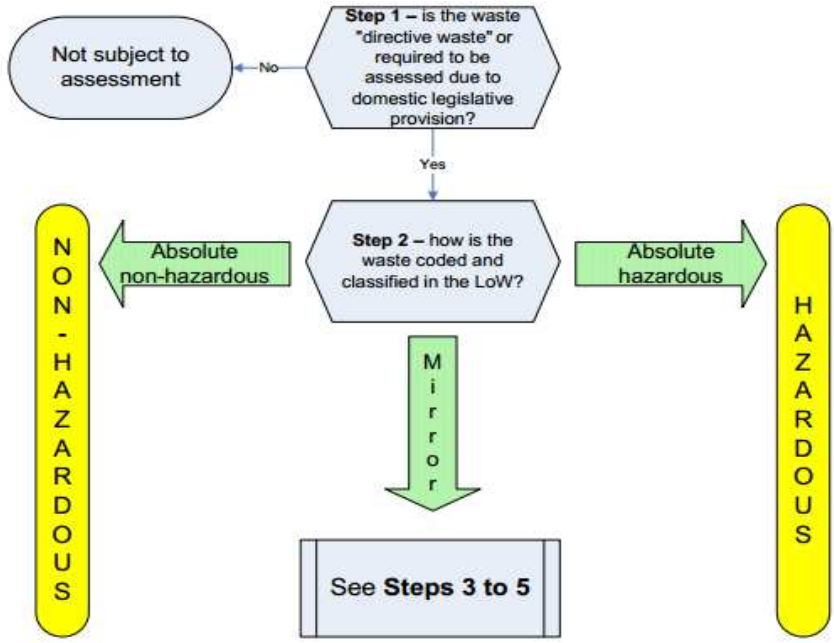
Metal	**Worst case compound**	worst case conversion factor
Arsenic	arsenic pentoxide	1.533
Cadmium	cadmium oxide	1.143
Chromium	chromium (VI) oxide	1.923
Copper	copper (I) oxide	1.126
Lead	Lead sulphate	1.464
Mercury	mercury oxide	1.08
Nickel	nickel carbonate	2.017
Selenium	Selenium dioxide	1.405
Zinc	zinc oxide	1.246
Vanadium	vanadium pentoxide	1.784

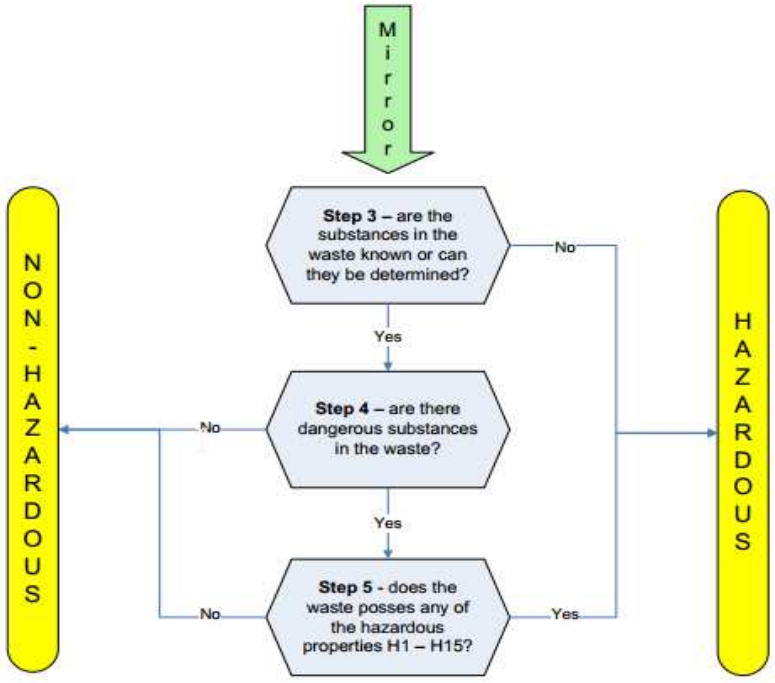
Risk phrases associated with common contaminants

Sample ID:	**Classification**	**Labelling**	**Ecotoxic Concentration Limits**

Arsenic (worst case)	Carc. Cat. 1; R45 T; R23/25 N; R50-53	R: 45-23/25-50/53 S: 53-45-60-61	No
Cadmium (worst case)	Carc. Cat. 2; R45 Muta. Cat. 3; R68 Repr. Cat. 3; R62-63 T+; R26 T; R48/23/25 N; R50-53	R: 45-26-48/23/25-62-63-68-50/53 S: 53-45-60-61	No
Chromium (worst case)	O; R9 Carc. Cat. 1; R45 Muta. Cat. 2; R46 Repr. Cat. 3; R62 T+; R26 T; R24/25-48/23 C; R35 R42/43 N; R50-53	R: 45-46-9-24/25-26-35-42/43-48/23-62-50/53 S: 53-45-60-61	No
Copper (worst case)	Xn; R22 N; R50-53	R: 22-50/53 S: (2-)22-60-61	No
Lead (worst case))	Repr. Cat. 1; R61 Repr. Cat. 3; R62 Xn; R20/22 R33 N; R50-53	R: 61-20/22-33-62-50/53 S: 53-45-60-61	No
Mercury (worst case)	T+; R26/27/28 R33 N; R50-53	R: 22-36/37/38-50/53 S: (2-)13-24/25-46-60-61	No
Nickel (worst case)	Carc. Cat. 1; R49 Muta. Cat. 3; R68 Repr. Cat. 2; R61 T; R48/23 Xn; R20/22 Xi; R38 R42/43 N; R50-53	R: 49-61-20/22-38-42/43-48/23-68-50/53 S: 53-45-60-61	No
Selenium (worst case)	T; R23/25 R33 N; R50-53	R: 23/25-33-50/53 S: (1/2-)20/21-28-45-60-61	No
Zinc (worst case)	N; R50-53	R: 50/53 S: 60-61	No
Vanadium (worst case)	Muta. Cat. 3; R68 Repr. Cat. 3; R63 T; R48/23 Xn; R20/22 Xi; R37 N; R51-53	R: 20/22-37-48/23-51/53-63-68 S: (1/2-)36/37-38-45-61	
Total Aliphatics (>C6 to C40)	Not on CLP		
Total Aromatics (>C6 to C40)	Not on CLP		
Total (>C6 to C40)	Not on CLP		No
naphthalene	Carc. Cat. 3; R40 Xn; R22 N; R50-53	R: 22-40-50/53 S: (2-)36/37-46-60-61	No
acenaphthylene	Not on CLP		No
acenaphthene	Not on CLP		No
fluorene	Not on CLP		No
phenanthrene	Not on CLP		No
anthracene	not on CLP, but SDS on Ox Uni site lists R50/53		No
fluoranthene	Not on CLP		No
pyrene	Not on CLP		No
benzo(a)anthracene	Carc. Cat. 2; R45 N; R50-53	R: 45-50/53 S: 53-45-60-61	N; R50-53: C ≥ 0,25 % N; R51-53: 0,025 % ≤ C < 0,25 % R52-53: 0,0025 % ≤ C < 0,025 %
chrysene	Carc. Cat. 2; R45 Muta. Cat. 3; R68 N; R50-53	R: 45-68-50/53 S: 53-45-60-61	No
benzo(b)fluoranthene	not on CLP, but SDS on Ox Uni site lists R45, R50/53		No
benzo(k)fluoranthene	Carc. Cat. 2; R45 N; R50-53	R: 45-50/53 S: 53-45-60-61	No

benzo(a)pyrene	Carc. Cat. 2; R45 Muta. Cat. 2; R46 Repr. Cat. 2; R60-61 R43 N; R50-53	R: 45-46-60-61-43-50/53 S: 53-45-60-61	No
dibenzo(ah)anthracene	Carc. Cat. 2; R45 N; R50-53	R: 45-50/53 S: 53-45-60-61	C ≥ 0,01 %: Carc. Cat. 2; R45 C ≥ 0,25 %: N; R50-53 0,025 % ≤ C < 0,25 %: N; R51-53 0,0025 % ≤ C < 0,025 %: R52-53
benzo(ghi)perylene	Not on CLP, but SDS on Ox Uni site lists R50/53		No
indeno(123cd)pyrene	Not on CLP		No
PAH (Total - SUM EPA16)			
tributyltin compounds, with the exception of those specified elsewhere in this Annex	T; R25-48/23/25 Xn; R21 Xi; R36/38 N; R50-53	R: 21-25-36/38-48/23/25-50/53 S: (1/2-)36/37/39-45-60-61	C ≥ 2,5 %: T; R25 0,25 % ≤ C < 2,5 %: Xn; R22 R21: Xn C ≥ 1 %: T; R48/23/25 0,25 % ≤ C < 1 %: Xn; R48/20/22 C ≥ 1 %: Xi; R36/38 C ≥ 2,5 %: N; R50-53 0,25 % ≤ C < 2,5 %: N; R51-53 0,025 % ≤ C < 0,25 %: R52-53
triphenyltin compounds, with the exception of those specified elsewhere in this Annex	T; R23/24/25 N; R50-53	R: 23/24/25-50/53 S: (1/2-)26-27-28-45-60-61	C ≥ 1 %: T; R23/24/25 0,25 % ≤ C < 1 %: Xn; R20/21/22 C ≥ 0,25 %: N; R50-53 0,025 % ≤ C < 0,25 %: N; R51-53 0,0025 % ≤ C < 0,025 %: R52-53
dibutyltin dichloride; (DBTC)	Mut. Cat. 3; R68 Repr. Cat. 2; R60-61 T+; R26 T; R25-48/25 C; R34 Xn; R21 N; R50-53	R: 60-61-21-25-26-34-48/25-68-50/53 S: 53-45-60-61	C ≥ 10 %: C; R34 0,01 % ≤ C < 10 %: Xi; R36/38 C ≥ 2,5 %: N; R50-53 0,25 % ≤ C < 2,5 %: N; R51-53 0,025 % ≤ C < 0,25 %: R52-53
tetrabutyltin	not on CLP		


Step 1 – is the waste "directive waste" or required to be assessed due to domestic legislative provision?
No
Not subject to assessment
Yes
Step 2 – how is the waste coded and classified in the LoW?
Absolute non-hazardous
Absolute hazardous
NON-HAZARDOUS
HAZARDOUS
Mirror
See Steps 3 to 5


Mirror
Step 3 – are the substances in the waste known or can they be determined?
No
Yes
Step 4 – are there dangerous substances in the waste?
No
Yes
Step 5 - does the waste posses any of the hazardous properties H1 – H15?
No
Yes
NON-HAZARDOUS
HAZARDOUS

Step 1	Yes - the sediment would be Directive waste according to the Waste Framework Directive
Step 2	17 05 05* **or 17 05 06 = Mirror entry - code to be determined by data from chemical analysis**
Step 3	Can be determined by chemical analysis
Step 4	Tested in accordance with the procedures in this spreadsheet
Step 5	Outcome presented in the 'Results' tab

Hazard Definitions

H1	Explosive
H2	Oxidising
H3a	Highly Flammable
H3b	Flammable
H4	Irritant
H5	Harmful
H6	Toxic
H7	Carcinogenic
H8	Corrosive
H9	Infectious
H10	Toxic for Reproduction
H11	Mutagenic
H12	Releases toxic or very toxic gases in contact with water, air or an acid
H13	Sensitising
H14	Excotoxic
H15	Capable by any means, after disposal, of yieling another substance which posesses any of the characteristics listed above

Station	VC03A 0m	VC03A 0.7m
Lab ID	A01	A02
H6 Assessment	not hazardous by H6	not hazardous by H6
H7 Assessment for metals	not hazardous by H7	not hazardous by H7
H7 Assessment for Oil (TPH/B[a]P ratio)	hazardous by H7	not-hazardous by H7
H10 Assessment	not hazardous by H10	not hazardous by H10
H11 Assessment (chromium)	not-hazardous by H11	not-hazardous by H11
H11 Assessment (TPH)	hazardous by H11	not-hazardous by H11
H14 Assessment	NOT Hazardous by H14	NOT Hazardous by H14

Conclusion:

H6

Six samples possesses the hazardous property H6: VC04 2m; VC08A 2m; VC05 3.48m; VC07 3m; VC07 4.87m; VC05A 3.78m

H7

Six samples possesses the hazardous property H7 on the basis of heavy metal concentration: VC04 2m; VC08A 2m; VC05 3.48m; VC07 3m; VC07 4.87m; VC05A 3.78m
17 out of the 38 samples possess the hazardous property H7 on the basis of hydrocarbon contamination (this includes five of the six samples above - the exception is VC07 3m).
Therefore, in total 18 samples exceed the hazardous waste threshold for hazardous property H7.

H10

No sample possesses the hazardous property H10

H11

Six samples possesses the hazardous property H11 on the basis of individual mutagen substance (Chromium): VC04 2m; VC08A 2m; VC05 3.48m; VC07 3m; VC07 4.87m; VC05A 3.78m
17 out of the 38 samples possess the hazardous property H11 on the basis of hydrocarbon contamination

H14

Five samples possess the hazardous property H14:
VC04 2m;
VC08A 2m;
VC05 3.48m;
VC07 3m and 4.8m

VC03A 1.24m A03	VC03A 1.79m A04	VC04 0m A05	VC04 1m A06
not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6
not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7
not-hazardous by H7	not-hazardous by H7	not-hazardous by H7	not-hazardous by H7
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11
NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14

VC04 2m A07	VC04 3m A08	VC04 4m A09	VC04 4.53m A10
hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6
hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7
hazardous by H7	hazardous by H7	hazardous by H7	not-hazardous by H7
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10
hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11
hazardous by H11	hazardous by H11	hazardous by H11	not-hazardous by H11
Hazardous by H14	Not hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14

VC06 0m A11	VC06 1m A12	VC06 2m B01	VC06 3m B02
not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6
not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7
not-hazardous by H7	not-hazardous by H7	not-hazardous by H7	hazardous by H7
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	hazardous by H11
NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14

VC06 4.18m B03	VC02A 0m B04	VC02A 0.86m B05	VC08A 0m B06
not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6
not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7
hazardous by H7	not-hazardous by H7	not-hazardous by H7	not-hazardous by H7
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11
hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11
Not hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14

VC08A 1m B07	VC08A 2m B08	VC08A 3m B09	VC08A 4m B10
not hazardous by H6	hazardous by H6	not hazardous by H6	not hazardous by H6
not hazardous by H7	hazardous by H7	not hazardous by H7	not hazardous by H7
hazardous by H7	hazardous by H7	hazardous by H7	not-hazardous by H7
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10
not-hazardous by H11	hazardous by H11	not-hazardous by H11	not-hazardous by H11
hazardous by H11	hazardous by H11	hazardous by H11	not-hazardous by H11
Not hazardous by H14	Hazardous by H14	Not hazardous by H14	Not hazardous by H14

VC08A 4.68m B11	VC05 0m B12	VC05 1m B13	VC05 2m C01
not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6
not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7
not-hazardous by H7	not-hazardous by H7	not-hazardous by H7	hazardous by H7
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	hazardous by H11
NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14

VC05 3m C02	VC05 3.48m C03	VC01A 0m C04	VC01A 1m C05
not hazardous by H6	hazardous by H6	not hazardous by H6	not hazardous by H6
not hazardous by H7	hazardous by H7	not hazardous by H7	not hazardous by H7
hazardous by H7	hazardous by H7	not-hazardous by H7	not-hazardous by H7
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10
not-hazardous by H11	hazardous by H11	not-hazardous by H11	not-hazardous by H11
hazardous by H11	hazardous by H11	not-hazardous by H11	not-hazardous by H11
Not hazardous by H14	Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14

VC01A 1.6m C06	VC07 0m C07	VC07 1m C08	VC07 2m C09
not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6
not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7
not-hazardous by H7	not-hazardous by H7	hazardous by H7	hazardous by H7
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11
not-hazardous by H11	not-hazardous by H11	hazardous by H11	hazardous by H11
NOT Hazardous by H14	NOT Hazardous by H14	Not hazardous by H14	NOT Hazardous by H14

VC07 3m C10	VC07 4m C11	VC07 4.87m C12	VC05A 3.78m C13
hazardous by H6	not hazardous by H6	hazardous by H6	hazardous by H6
hazardous by H7	not hazardous by H7	hazardous by H7	hazardous by H7
not-hazardous by H7	hazardous by H7	hazardous by H7	hazardous by H7
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10
hazardous by H11	not-hazardous by H11	hazardous by H11	hazardous by H11
not-hazardous by H11	hazardous by H11	hazardous by H11	hazardous by H11
Hazardous by H14	Not hazardous by H14	Hazardous by H14	Not hazardous by H14

Very Toxic H6:

The **very toxic threshold is 0.1%** (1000mg/kg) and applies to the **total concentration** of very toxic substances in the waste (cadmium, chromium (VI) and mercury). The worst case substance should be used for metal results.
DBT is also classified as very toxic. As this is a substance, there is no requirement to factor a 'worst case'.
Only very toxic applies. The hazardous waste threshold for Toxic is 3% (i.e. 30000 mg/kg)
Relevant risk phrases are:
R26 (very toxic by inhlation)
R27 (very toxic in contact with skin)

R28 (very toxic id swallowed)

Station Lab ID		VC03A 0m A01	VC03A 0.7m A02	VC03A 1.24m A03	VC03A 1.79m A04	VC04 0m A05	VC04 1m A06	VC04 2m A07	VC04 3m A08	VC04 4m A09	VC04 4.53m A10	VC06 0m A11	VC06 1m A12	VC06 2m B01
	worst case factor													
[Cd]		0.73	0.90	0.08	0.02	0.48	0.65	2.75	3.98	2.01	0.08	0.52	0.26	0.48
[Cd] corrected for worst case	1.143	0.84	1.03	0.09	0.03	0.55	0.74	3.14	4.55	2.30	0.10	0.59	0.30	0.55
[Cr]		85.20	81.20	27.90	61.80	80.20	84.70	523.00	390.00	371.00	22.20	80.60	41.60	55.70
[Cr] corrected for worst case	1.923	163.84	156.15	53.65	118.84	154.22	162.88	1005.73	749.97	713.43	42.69	154.99	80.00	107.11
[Hg]		1.35	2.65	0.34	0.02	0.51	0.77	15.90	49.00	28.50	0.44	0.51	0.54	1.49
[Hg] corrected for worst case	1.08	1.46	2.86	0.37	0.02	0.55	0.84	17.17	52.92	30.78	0.48	0.55	0.58	1.61
dibutyl tin (DBT)	not applicable	0.002	0.213	0.004	0.002	0.027	0.055	0.124	0.140	0.006	0.002	0.002	0.068	0.018
Sum of very toxic substances		**166.14**	**160.25**	**54.11**	**118.89**	**155.35**	**164.51**	**1026.17**	**807.58**	**746.52**	**43.27**	**156.13**	**80.95**	**109.28**
Any very toxic concentration >=1000 mg/kg?		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Toxic/non-toxic		not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6

Conclusion

Six samples possesses the hazardous property H6:
VC04 2m; VC08A 2m; VC05 3.48m; VC07 3m; VC07 4.87m; VC05A 3.78m

VC06 3m B02	VC06 4.18m B03	VC02A 0m B04	VC02A 0.86m B05	VC08A 0m B06	VC08A 1m B07	VC08A 2m B08	VC08A 3m B09	VC08A 4m B10	VC08A 4.68m B11	VC05 0m B12	VC05 1m B13	VC05 2m C01	VC05 3m C02	VC05 3.48m C03	VC01A 0m C04
1.88	2.54	0.39	0.53	0.59	2.19	7.52	3.26	1.53	0.05	0.51	0.58	1.07	4.69	5.04	0.34
2.15	2.90	0.44	0.61	0.67	2.50	8.60	3.73	1.75	0.05	0.58	0.66	1.22	5.36	5.76	0.39
250.00	338.00	76.80	96.10	80.70	368.00	547.00	359.00	62.30	7.32	87.20	91.10	134.00	446.00	645.00	72.80
480.75	649.97	147.69	184.80	155.19	707.66	1051.88	690.36	119.80	14.08	167.69	175.19	257.68	857.66	1240.34	139.99
1.68	8.09	0.47	0.66	0.72	1.34	45.10	19.90	8.06	0.10	0.63	0.88	0.83	37.50	86.90	1.06
1.81	8.74	0.50	0.71	0.78	1.45	48.71	21.49	8.70	0.11	0.68	0.95	0.89	40.50	93.85	1.14
0.374	0.285	0.002	0.048	0.057	0.325	0.261	0.026	0.009	0.002	0.002	0.002	0.019	0.169	0.208	0.005
485.09	**661.90**	**148.64**	**186.17**	**156.69**	**711.94**	**1109.45**	**715.60**	**130.27**	**14.24**	**168.95**	**176.80**	**259.82**	**903.69**	**1340.16**	**141.53**
NO	**NO**	**NO**	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**YES**	**NO**
not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	hazardous by H6	not hazardous by H6

VC01A 1m C05	VC01A 1.6m C06	VC07 0m C07	VC07 1m C08	VC07 2m C09	VC07 3m C10	VC07 4m C11	VC07 4.87m C12	VC05A 3.78m C13	0 0	0 0	0 0
0.39	0.40	0.58	2.29	2.07	2.67	4.12	5.45	4.52			
0.44	0.45	0.66	2.62	2.37	3.05	4.71	6.23	5.17			
81.60	93.60	89.30	279.00	301.00	560.00	445.00	569.00	588.00			
156.92	179.99	171.72	536.52	578.82	1076.88	855.74	1094.19	1130.72			
0.51	0.59	0.76	1.37	4.65	14.80	34.60	52.00	69.90			
0.55	0.63	0.82	1.48	5.02	15.98	37.37	56.16	75.49			
0.012	0.008	0.012	0.137	0.190	0.317	0.651	0.042	0.048			
157.92	**181.09**	**173.22**	**540.75**	**586.40**	**1096.23**	**898.46**	**1156.62**	**1211.43**			
NO	**NO**	**NO**	**NO**	**NO**	**YES**	**NO**	**YES**	**YES**			
not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	not hazardous by H6	hazardous by H6	not hazardous by H6	hazardous by H6	hazardous by H6			

H7: Carcinogenicity

The generic carcinogenic threshold is 1000 mg/kg and applies to single substances only, it is not an accumulation of all carcinogenic substances.
For the non-metal species, it is not necessary to apply a factor to the results, because they are already presented as substance concentrations.

Relevant Risk Phrases
Category 1 and 2

R45	May cause cancer
R49	May cause cancer by inhalation

H7 Metals

Station Lab ID		VC03A 0m A01	VC03A 0.7m A02	VC03A 1.24m A03
Carcinogen (adjusted for worst case)	Worst case factor			
[As]		26	16.2	10.3
[As2O5]	1.533	39.86	24.83	15.79
[Cd]		0.734	0.902	0.077
[CdO]	1.143	0.84	1.03	0.09
[Cr]		85.2	81.2	27.9
[CrO3]	1.923	163.84	156.15	53.65
[Ni]		39	32.4	16
[NiCO3]	2.017	78.66	65.35	32.27
Is one substance >= 1000 mg/kg?		**No**	**No**	**No**
		not hazardous by H7	not hazardous by H7	not hazardous by H7

H7 Organics

New WM2 version 3 Assessment - England & Wales
TPH and PAH Assessment
If the TPH =>1000 mg/kg, the advice provided in WM2 Appendix A, Example 3 will apply.
This requires an assessment to determine whether the 'oil' in the waste is carcinogenic or not. This is done by ratio of the benzo-a-pyrene concentration to the TPH concentration. Where the ratio exceeds 1 in 10000 (i.e. >0.0001), the conclusion is that the 'oil' is carcinogenic.

Station Lab ID	VC03A 0m A01	VC03A 0.7m A02	VC03A 1.24m A03	VC03A 1.79m A04
Carcinogenic PAH				
Benzo(a)pyrene	0.222	0.375	0.0066	0.0092
TPH result =	1120.00	937.00	9.10	52.10
Is the TPH threshold exceeded?	yes	no	no	no
Ratio =	0.00020	0.00040	0.00073	0.00018
Carcinogenic threshold exceeded?	Yes	No	No	No
	hazardous by H7	not-hazardous by H7	not-hazardous by H7	not-hazardous by H7

Conclusion

Six samples possesses the hazardous property H7 on the basis of heavy metal concentration:
VC04 2m; VC08A 2m; VC05 3.48m; VC07 3m; VC07 4.87m; VC05A 3.78m
17 out of the 38 samples possess the hazardous property H7 on the basis of hydrocarbon contamination (this includes five of the six samples above - the exception is VC07 3m).
Therefore, in total 18 samples exceed the hazardous waste threshold for hazardous property H7.

VC03A 1.79m A04	VC04 0m A05	VC04 1m A06	VC04 2m A07	VC04 3m A08	VC04 4m A09
4.09	27.4	22	9.17	18.5	25.5
6.27	42.00	33.73	14.06	28.36	39.09
0.024	0.481	0.651	2.75	3.98	2.01
0.03	0.55	0.74	3.14	4.55	2.30
61.8	80.2	84.7	523	390	371
118.84	154.22	162.88	1005.73	749.97	713.43
42	38.7	40.6	57.1	52.4	73.9
84.71	78.06	81.89	115.17	105.69	149.06
No	**No**	**No**	**Yes**	**No**	**No**
not hazardous by H7	not hazardous by H7	not hazardous by H7	hazardous by H7	not hazardous by H7	not hazardous by H7

VC04 0m A05	VC04 1m A06	VC04 2m A07	VC04 3m A08	VC04 4m A09	VC04 4.53m A10
0.275	0.0605	0.336	0.565	0.57	0.0112
627.00	231.00	2010.00	2910.00	3910.00	54.80
no	no	yes	yes	yes	no
0.00044	0.00026	0.00017	0.00019	0.00015	0.00020
No	No	Yes	Yes	Yes	No
not-hazardous by H7	not-hazardous by H7	hazardous by H7	hazardous by H7	hazardous by H7	not-hazardous by H7

VC04 4.53m A10	VC06 0m A11	VC06 1m A12	VC06 2m B01	VC06 3m B02	VC06 4.18m B03
4.84	29.1	15.9	12.8	16.2	19.8
7.42	44.61	24.37	19.62	24.83	30.35
0.084	0.517	0.264	0.478	1.88	2.54
0.10	0.59	0.30	0.55	2.15	2.90
22.2	80.6	41.6	55.7	250	338
42.69	154.99	80.00	107.11	480.75	649.97
10.8	37.3	20.4	22.2	69.5	65.2
21.78	75.23	41.15	44.78	140.18	131.51
No	**No**	**No**	**No**	**No**	**No**
not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7

VC06 0m A11	VC06 1m A12	VC06 2m B01	VC06 3m B02	VC06 4.18m B03	VC02A 0m B04
0.0918	0.0818	0.166	0.347	0.392	0.198
148.00	249.00	523.00	1420.00	2040.00	296.00
no	no	no	yes	yes	no
0.00062	0.00033	0.00032	0.00024	0.00019	0.00067
No	No	No	Yes	Yes	No
not-hazardous by H7	not-hazardous by H7	not-hazardous by H7	hazardous by H7	hazardous by H7	not-hazardous by H7

VC02A 0m B04	VC02A 0.86m B05	VC08A 0m B06	VC08A 1m B07	VC08A 2m B08	VC08A 3m B09
31.2	27.1	27.5	17	35.2	39.3
47.83	41.54	42.16	26.06	53.96	60.25
0.389	0.533	0.59	2.19	7.52	3.26
0.44	0.61	0.67	2.50	8.60	3.73
76.8	96.1	80.7	368	547	359
147.69	184.80	155.19	707.66	1051.88	690.36
34.1	39.9	35.1	69.3	41	38
68.78	80.48	70.80	139.78	82.70	76.65
No	**No**	**No**	**No**	**Yes**	**No**
not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7	hazardous by H7	not hazardous by H7

VC02A 0.86m B05	VC08A 0m B06	VC08A 1m B07	VC08A 2m B08	VC08A 3m B09	VC08A 4m B10
0.117	0.15	0.409	0.609	0.321	0.0713
272.00	418.00	1820.00	3250.00	1740.00	236.00
no	no	yes	yes	yes	no
0.00043	0.00036	0.00022	0.00019	0.00018	0.00030
No	No	Yes	Yes	Yes	No
not-hazardous by H7	not-hazardous by H7	hazardous by H7	hazardous by H7	hazardous by H7	not-hazardous by H7

VC08A 4m B10	VC08A 4.68m B11	VC05 0m B12	VC05 1m B13	VC05 2m C01	VC05 3m C02
16.1	5.26	31.3	28.2	22.8	39.2
24.68	8.06	47.98	43.23	34.95	60.09
1.53	0.045	0.51	0.579	1.07	4.69
1.75	0.05	0.58	0.66	1.22	5.36
62.3	7.32	87.2	91.1	134	446
119.80	14.08	167.69	175.19	257.68	857.66
22.2	4.9	38.6	38.8	52.5	42.6
44.78	9.88	77.86	78.26	105.89	85.92
No	**No**	**No**	**No**	**No**	**No**
not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7

VC08A 4.68m B11	VC05 0m B12	VC05 1m B13	VC05 2m C01	VC05 3m C02	VC05 3.48m C03
0.0037	0.158	0.209	0.318	0.371	0.851
11.80	305.00	622.00	1200.00	1850.00	6690.00
no	no	no	yes	yes	yes
0.00031	0.00052	0.00034	0.00027	0.00020	0.00013
No	No	No	Yes	Yes	Yes
not-hazardous by H7	not-hazardous by H7	not-hazardous by H7	hazardous by H7	hazardous by H7	hazardous by H7

VC05 3.48m C03	VC01A 0m C04	VC01A 1m C05	VC01A 1.6m C06	VC07 0m C07	VC07 1m C08
58.9	36.8	35.1	32.9	31.3	14.9
90.29	56.41	53.81	50.44	47.98	22.84
5.04	0.338	0.389	0.396	0.581	2.29
5.76	0.39	0.44	0.45	0.66	2.62
645	72.8	81.6	93.6	89.3	279
1240.34	139.99	156.92	179.99	171.72	536.52
39.2	32.8	36	39.9	39.9	68.5
79.07	66.16	72.61	80.48	80.48	138.16
Yes	**No**	**No**	**No**	**No**	**No**
hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7	not hazardous by H7

VC01A 0m C04	VC01A 1m C05	VC01A 1.6m C06	VC07 0m C07	VC07 1m C08	VC07 2m C09
0.148	0.124	0.135	0.108	1.08	0.31
117.00	139.00	208.00	224.00	3160.00	2020.00
no	no	no	no	yes	yes
0.00126	0.00089	0.00065	0.00048	0.00034	0.00015
No	No	No	No	Yes	Yes
not-hazardous by H7	not-hazardous by H7	not-hazardous by H7	not-hazardous by H7	hazardous by H7	hazardous by H7

VC07 2m C09	VC07 3m C10	VC07 4m C11	VC07 4.87m C12	VC05A 3.78m C13	0 0
25	24.7	41.9	32.1	30	
38.33	37.87	64.23	49.21	45.99	
2.07	2.67	4.12	5.45	4.52	
2.37	3.05	4.71	6.23	5.17	
301	560	445	569	588	
578.82	1076.88	855.74	1094.19	1130.72	
51.7	45.5	37.4	39.1	38.2	
104.28	91.77	75.44	78.86	77.05	
No	**Yes**	**No**	**Yes**	**Yes**	
not hazardous by H7	hazardous by H7	not hazardous by H7	hazardous by H7	hazardous by H7	

VC07 3m C10	VC07 4m C11	VC07 4.87m C12	VC05A 3.78m C13	0 0
0.223	0.609	0.49	0.463	
3720.00	4070.00	3180.00	1540.00	
yes	yes	yes	yes	
0.00006	0.00015	0.00015	0.00030	
No	Yes	Yes	Yes	
not-hazardous by H7	hazardous by H7	hazardous by H7	hazardous by H7	

Toxic for reproduction (H10)

Lead substances, benzo[a]pyrene, dibutyl tin and the worst case nickel substance are classified as toxic for reproduction (H10).
This means these substances are generally considered to induce non-hereditary congenital malformations or increase their incidence if they are inhaled or ingested or if they penetrate the skin (unless data demonstrates otherwise)
The lowest threshold for this hazardous property is 5000 mg/kg **This threshold applies to substances classified with R60 or R61**
This is based on a single substance only, there is no addition with any other substance.
The hazardous assessment for H10 is based upon a single substance exceeding the threshold. It is not an additive threshold.

Relevant risk phrases

R60	May impair fertility
R61	May cause harm to the unborn child

Station Lab ID		VC03A 0m A01	VC03A 0.7m A02	VC03A 1.24m A03	VC03A 1.79m A04	VC04 0m A05	VC04 1m A06	VC04 2m A07	VC04 3m A08	VC04 4m A09	VC04 4.53m A10	VC06 0m A11	VC06 1m A12	VC06 2m B01
	Worst case													
Carcinogen (adjusted for worst case)														
Benzo(a)pyrene	not applicable	0.222	0.375	0.0066	0.0092	0.275	0.0605	0.336	0.565	0.57	0.0112	0.0918	0.0818	0.166
Dibutyl Tin	not applicable	0.002	0.213	0.00426	0.002	0.0274	0.0545	0.124	0.14	0.00595	0.002	0.002	0.0679	0.0183
[Pb]		118	101	36.3	8.57	115	113	143	163	135	20.8	126	58.6	68.7
[PbSO4]	1.464	172.75	147.86	53.14	12.55	168.36	165.43	209.35	238.63	197.64	30.45	184.46	85.79	100.58
[Ni]		39	32.4	16	42	38.7	40.6	57.1	52.4	73.9	10.8	37.3	20.4	22.2
[NiCO3]	2.017	78.66	65.35	32.27	84.71	78.06	81.89	115.17	105.69	149.06	21.78	75.23	41.15	44.78
Is any one substance present at 5000 mg/kg or more?		**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
		not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10

Conclusion

No sample possesses the hazardous property H10

VC06 3m B02	VC06 4.18m B03	VC02A 0m B04	VC02A 0.86m B05	VC08A 0m B06	VC08A 1m B07	VC08A 2m B08	VC08A 3m B09	VC08A 4m B10	VC08A 4.68m B11	VC05 0m B12	VC05 1m B13	VC05 2m C01	VC05 3m C02	VC05 3.48m C03	VC01A 0m C04
0.347	0.392	0.198	0.117	0.15	0.409	0.609	0.321	0.0713	0.0037	0.158	0.209	0.318	0.371	0.851	0.148
0.374	0.285	0.002	0.048	0.0565	0.325	0.261	0.026	0.00861	0.002	0.002	0.002	0.0194	0.169	0.208	0.00468
140	161	107	112	108	152	208	186	82.2	4.9	128	109	131	239	257	104
204.96	235.70	156.65	163.97	158.11	222.53	304.51	272.30	120.34	7.17	187.39	159.58	191.78	349.90	376.25	152.26
69.5	65.2	34.1	39.9	35.1	69.3	41	38	22.2	4.9	38.6	38.8	52.5	42.6	39.2	32.8
140.18	131.51	68.78	80.48	70.80	139.78	82.70	76.65	44.78	9.88	77.86	78.26	105.89	85.92	79.07	66.16
No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10

VC01A 1m C05	VC01A 1.6m C06	VC07 0m C07	VC07 1m C08	VC07 2m C09	VC07 3m C10	VC07 4m C11	VC07 4.87m C12	VC05A 3.78m C13	0 0
0.124	0.135	0.108	1.08	0.31	0.223	0.609	0.49	0.463	
0.012	0.00834	0.0117	0.137	0.19	0.317	0.651	0.0422	0.0483	
127	133	127	145	188	118	252	195	172	
185.93	194.71	185.93	212.28	275.23	172.75	368.93	285.48	251.81	
36	39.9	39.9	68.5	51.7	45.5	37.4	39.1	38.2	
72.61	80.48	80.48	138.16	104.28	91.77	75.44	78.86	77.05	
No	No	No	No	No	No	No	No	No	
not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	not hazardous by H10	

H11 Mutagenic

The generic mutagenic threshold is 1000 mg/kg for Cat 1 and 2 substances and applies to single substances only, it is not an accumulation of all cat 1 or 2 mutagenic substances.–The threshold for Cat 3 individual substances is 10,000 mg/kg.

For the non-metal species, it is not necessary to apply a factor to the results, because they are already presented as substance concentrations.

Relevant Risk Phrases

Category 1 and 2

R46 May cause heritable genetic damage

R68 Possible risk of irreversible effects

Station		**VC03A 0m**	**VC03A 0.7m**
Mutagens:	**worst case conversion factor**		
Benzo(a)pyrene	x	0.222	0.375
[Cr]		85.20	81.20
[Cr] corrected for worst case	**1.923**	163.84	156.15
Any mutageniuc substance >1000mg/kg?		No	No
		not-hazardous by H11	not-hazardous by H11

WM2 Appendix A, Example 3 identifies that if a waste contains oil that is considered to be carcinogenic on the basis of

Assessment against the B-a-P:TPH ratio outcome:

Station	**VC03A 0m**	**VC03A 0.7m**	**VC03A 1.24m**
Lab ID	**A01**	**A02**	**A03**
Carcinogenic PAH			
Benzo(a)pyrene	0.222	0.375	0.0066
TPH result =	1120.00	937.00	9.10
Is the TPH threshold exceeded?	yes	no	no
Ratio =	0.0002	0.0004	0.0007
Carcinogenic threshold exceeded?	Yes	No	No
	hazardous by H11	not-hazardous by H11	not-hazardous by H11

Conclusion

Six samples possesses the hazardous property H11 on the basis of individual mutagen substance (Chromium): VC04 2m; VC08A 2m; VC05 3.48m; VC07 3m; VC07 4.87m; VC05A 3.78m
17 out of the 38 samples possess the hazardous property H11 on the basis of hydrocarbon contamination

VC03A 1.24m	VC03A 1.79m	VC04 0m	VC04 1m	VC04 2m	VC04 3m
0.0066	0.0092	0.275	0.0605	0.336	0.565
27.90	61.80	80.20	84.70	523.00	390.00
53.65	118.84	154.22	162.88	1005.73	749.97
No	No	No	No	Yes	No
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H	hazardous by H11	not-hazardous by H

the benzo-a-pyrene to TPH ratio, it will also be considered to possess hazardous property H11

VC03A 1.79m A04	VC04 0m A05	VC04 1m A06	VC04 2m A07	VC04 3m A08	VC04 4m A09
0.0092	0.275	0.0605	0.336	0.565	0.57
52.10	627.00	231.00	2010.00	2910.00	3910.00
no	no	no	yes	yes	yes
0.0002	0.0004	0.0003	0.0002	0.0002	0.0001
No	No	No	Yes	Yes	Yes
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	hazardous by H11	hazardous by H11	hazardous by H11

VC04 4m	VC04 4.53m	VC06 0m	VC06 1m	VC06 2m	VC06 3m
0.57	0.0112	0.0918	0.0818	0.166	0.347
371.00	22.20	80.60	41.60	55.70	250.00
713.43	42.69	154.99	80.00	107.11	480.75
No	No	No	No	No	No
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H	not-hazardous by H

VC04 4.53m A10	VC06 0m A11	VC06 1m A12	VC06 2m B01	VC06 3m B02	VC06 4.18m B03
0.0112	0.0918	0.0818	0.166	0.347	0.392
54.80	148.00	249.00	523.00	1420.00	2040.00
no	no	no	no	yes	yes
0.0002	0.0006	0.0003	0.0003	0.0002	0.0002
No	No	No	No	Yes	Yes
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	hazardous by H11	hazardous by H11

VC06 4.18m	VC02A 0m	VC02A 0.86m	VC08A 0m	VC08A 1m	VC08A 2m
0.392	0.198	0.117	0.15	0.409	0.609
338.00	76.80	96.10	80.70	368.00	547.00
649.97	147.69	184.80	155.19	707.66	1051.88
No	No	No	No	No	Yes
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H	not-hazardous by H	hazardous by H11

VC02A 0m B04	VC02A 0.86m B05	VC08A 0m B06	VC08A 1m B07	VC08A 2m B08	VC08A 3m B09
0.198	0.117	0.15	0.409	0.609	0.321
296.00	272.00	418.00	1820.00	3250.00	1740.00
no	no	no	yes	yes	yes
0.0007	0.0004	0.0004	0.0002	0.0002	0.0002
No	No	No	Yes	Yes	Yes
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	hazardous by H11	hazardous by H11	hazardous by H11

VC08A 3m	VC08A 4m	VC08A 4.68m	VC05 0m	VC05 1m	VC05 2m
0.321	0.0713	0.0037	0.158	0.209	0.318
359.00	62.30	7.32	87.20	91.10	134.00
690.36	119.80	14.08	167.69	175.19	257.68
No	No	No	No	No	No
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H	not-hazardous by H

VC08A 4m B10	VC08A 4.68m B11	VC05 0m B12	VC05 1m B13	VC05 2m C01	VC05 3m C02
0.0713	0.0037	0.158	0.209	0.318	0.371
236.00	11.80	305.00	622.00	1200.00	1850.00
no	no	no	no	yes	yes
0.0003	0.0003	0.0005	0.0003	0.0003	0.0002
No	No	No	No	Yes	Yes
not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	hazardous by H11	hazardous by H11

VC05 3m	VC05 3.48m	VC01A 0m	VC01A 1m	VC01A 1.6m	VC07 0m
0.371	0.851	0.148	0.124	0.135	0.108
446.00	645.00	72.80	81.60	93.60	89.30
857.66	1240.34	139.99	156.92	179.99	171.72
No	Yes	No	No	No	No
not-hazardous by H	hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H

VC05 3.48m C03	VC01A 0m C04	VC01A 1m C05	VC01A 1.6m C06	VC07 0m C07	VC07 1m C08
0.851	0.148	0.124	0.135	0.108	1.08
6690.00	117.00	139.00	208.00	224.00	3160.00
yes	no	no	no	no	yes
0.0001	0.0013	0.0009	0.0006	0.0005	0.0003
Yes	No	No	No	No	Yes
hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	not-hazardous by H11	hazardous by H11

VC07 1m	VC07 2m	VC07 3m	VC07 4m	VC07 4.87m	VC05A 3.78m
1.08	0.31	0.223	0.609	0.49	0.463
279.00	301.00	560.00	445.00	569.00	588.00
536.52	578.82	1076.88	855.74	1094.19	1130.72
No	No	Yes	No	Yes	Yes
not-hazardous by H	not-hazardous by H11	hazardous by H11	not-hazardous by H	hazardous by H11	hazardous by H11

VC07 2m	VC07 3m	VC07 4m	VC07 4.87m	VC05A 3.78m	0
C09	C10	C11	C12	C13	0
0.31	0.223	0.609	0.49	0.463	
2020.00	3720.00	4070.00	3180.00	1540.00	
yes	yes	yes	yes	yes	
0.0002	0.0001	0.0001	0.0002	0.0003	
Yes	No	Yes	Yes	Yes	
hazardous by H11	not-hazardous by H11	hazardous by H11	hazardous by H11	hazardous by H11	

Ecotoxic (H14)

Heavy metals are ecotxic
All of the heavy metals in the spreadsheet are classed as very toxic to the aquatic organisms and may cause long-term adverse effects in the aquatic environment .
This means they have a classification of R50/53.
The hazardous waste threshold for R50/53 is 2500 mg/kg.
9 of the USEPA 16 priority PAHs are also similarly ecotoxic (indicated in green highlight).
These need to be included in the calculation
For ecotoxicity, this threshold applies to the **total concentration** of all substances with the classification of R50/53 in the waste.

Data screening for ecotoxicity
Process:
Step 1. Calculate the worst-case concentration for the heavy metal analysis results
Step 2. Is any one substance present at the threshold level or greater? If yes, the waste is ecotoxic; otherwise, proceed to the next step
Step 3. Is there a substance present which has a substance specific concentration threshold for an aquatic risk phrase in CLP Table 3.2? If yes, the waste is ecotoxic if that concentration threshold is exceeded; otherwise, proceed to the next step
Step 4. Screen out all of the 'trace impurity compounds', i.e. those R50-53, R51-53 or R50 present at less than 1000 mg/kg; or substances with any other aquatic risk phrase present at less than 10,000 mg/kg
WM2 section C14.5.5 identifies that R50-53 substances present at <1000mg/kg (based on the worst case concentration) can be excluded from the calculation
Step 5. Add together all of the substances with the same risk phrases.
Step 6. Are any of the generic thresholds exceeded? If yes, the waste is ecotoxic, otherwise, proceed to the next step
Step 7. Apply WM2 Appendix C14 equation 1 to the sum of the substances with risk phrases R50-53, R51-53 and R52-53. Is the total >1? If yes, the waste is ecotoxic, otherwise proceed to the next step.
Step 8. Apply WM2 Appendix C14 equation 2 to the sum of the substances with risk phrases R50 and R50-53. Is the total >25%? If yes, the waste is ecotoxic, otherwise proceed to the next step.
Step 8 is generally not used due to the very high thresholds
Step 9. Apply WM2 Appendix C14 equation 3 to the sum of the substances with risk phrase R52. Is the total >25%? If yes, the waste is ecotoxic, otherwise proceed to the next step.
Step 9 is generally not used due to the very high thresholds
Step 10. Apply WM2 Appendix C14 equation 4 to the sum of the substances with risk phrases R50 and R50-53. Is the total >25%? If yes, the waste is ecotoxic, otherwise proceed to the next step.
Step 10 is generally not used due to the very high thresholds

Relevant Aquatic Risk Phrases and thresholds		**Threshold (mg/kg)**
R50	Very toxic to aquatic organisms	250,000
R50-53	Very toxic to aquatic organisms and may cause long-term effects in the environment	2,500
R51-53	Toxic to aquatic organisms and may cause long-term effects in the environment	25,000
R52-53	Harmful to aquatic organisms and may cause long-term effects in the aquatic environment	250,000
R52	Harmful to aquatic organisms	250,000
R53	May cause lon-term effects in the aquatic environment	250,000

Station		**VC03A 0m**	**VC03A 0.7m**	**VC03A 1.24m**	**VC03A 1.79m**	**VC04 0m**	**VC04 1m**	**VC04 2m**	**VC04 3m**	**VC04 4m**	**VC04 4.53m**	**VC06 0m**	**VC06 1m**	**VC06 2m**
Ecotoxic PAH (if < LoD, enter the result as the LoD value)		**A01**	**A02**	**A03**	**A04**	**A05**	**A06**	**A07**	**A08**	**A09**	**A10**	**A11**	**A12**	**B01**
Anthracene		**0.91**	**2.07**	**0.01**	**0.04**	**0.62**	**0.23**	**4.39**	**9.68**	**10.30**	**0.03**	**0.12**	**0.21**	**0.65**
Benzo(a)anthracene		**0.41**	**0.83**	**0.01**	**0.02**	**0.51**	**0.13**	**1.08**	**2.32**	**2.23**	**0.02**	**0.17**	**0.19**	**0.37**
Benzo(a)pyrene		**0.22**	**0.38**	**0.01**	**0.01**	**0.28**	**0.06**	**0.34**	**0.57**	**0.57**	**0.01**	**0.09**	**0.08**	**0.17**
Benzo(b)fluoranthene		**0.36**	**0.49**	**0.01**	**0.01**	**0.46**	**0.12**	**0.31**	**0.47**	**0.43**	**0.02**	**0.16**	**0.18**	**0.26**
Benzo(k)fluoranthene		**0.15**	**0.23**	**0.00**	**0.01**	**0.20**	**0.05**	**0.14**	**0.21**	**0.19**	**0.01**	**0.07**	**0.07**	**0.12**
Benzo(g,h,i)perylene		**0.15**	**0.23**	**0.01**	**0.01**	**0.19**	**0.03**	**0.14**	**0.17**	**0.19**	**0.01**	**0.07**	**0.04**	**0.10**
Chrysene		**0.42**	**0.68**	**0.01**	**0.02**	**0.48**	**0.10**	**0.87**	**2.01**	**1.93**	**0.02**	**0.15**	**0.17**	**0.29**
Dibenzo(a,h)anthracene		**0.04**	**0.06**	**0.00**	**0.00**	**0.04**	**0.01**	**0.05**	**0.06**	**0.05**	**0.00**	**0.02**	**0.01**	**0.03**
Naphthalene		**1.43**	**2.14**	**0.04**	**0.06**	**1.33**	**0.34**	**12.90**	**21.60**	**23.90**	**0.84**	**0.30**	**0.43**	**1.21**
		0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Step 1														
Ecotoxic Metals														
Arsenic		26.00	16.20	10.30	4.09	27.40	22.00	9.17	18.50	25.50	4.84	29.10	15.90	12.80
Cadmium		0.73	0.90	0.08	0.02	0.48	0.65	2.75	3.98	2.01	0.08	0.52	0.26	0.48
Chromium		85.20	81.20	27.90	61.80	80.20	84.70	523.00	390.00	371.00	22.20	80.60	41.60	55.70
Copper		106.00	265.00	17.60	14.90	61.50	86.70	1510.00	1650.00	683.00	40.20	58.40	33.30	101.00
Lead		118.00	101.00	36.30	8.57	115.00	113.00	143.00	163.00	135.00	20.80	126.00	58.60	68.70
Mercury		1.35	2.65	0.34	0.02	0.51	0.77	15.90	49.00	28.50	0.44	0.51	0.54	1.49
Nickel		39.00	32.40	16.00	42.00	38.70	40.60	57.10	52.40	73.90	10.80	37.30	20.40	22.20
Zinc		301.00	240.00	48.80	71.20	210.00	241.00	773.00	476.00	512.00	51.20	221.00	194.00	270.00
Worst Case metals	Worst case factor													
Arsenic (worst case)	1.533	39.86	24.83	15.79	6.27	42.00	33.73	14.06	28.36	39.09	7.42	44.61	24.37	19.62
Cadmium (worst case)	1.143	0.84	1.03	0.09	0.03	0.55	0.74	3.14	4.55	2.30	0.10	0.59	0.30	0.55
Chromium (worst case)	1.923	163.84	156.15	53.65	118.84	154.22	162.88	1005.73	749.97	713.43	42.69	154.99	80.00	107.11
Copper (worst case)	1.126	119.36	298.39	19.82	16.78	69.25	97.62	1700.26	1857.90	769.06	45.27	65.76	37.50	113.73
Lead (worst case))	1.464	172.75	147.86	53.14	12.55	168.36	165.43	209.35	238.63	197.64	30.45	184.46	85.79	100.58
Mercury (worst case)	1.08	1.46	2.86	0.37	0.02	0.55	0.84	17.17	52.92	30.78	0.48	0.55	0.58	1.61
Nickel (worst case)	2.017	78.66	65.35	32.27	84.71	78.06	81.89	115.17	105.69	149.06	21.78	75.23	41.15	44.78
Zinc (worst case)	1.246	375.05	299.04	60.80	88.72	261.66	300.29	963.16	593.10	637.95	63.80	275.37	241.72	336.42

Step 2

Station	VC03A 0m	VC03A 0.7m	VC03A 1.24m	VC03A 1.79m	VC04 0m	VC04 1m	VC04 2m	VC04 3m	VC04 4m	VC04 4.53m	VC06 0m	VC06 1m	VC06 2m
Are there individual substances exceeding 2500 mg/kg	No	No	No	No	No	No	No	No	No	No	No	No	No

Step 3

Station		VC03A 0m	VC03A 0.7m	VC03A 1.24m	VC03A 1.79m									
Is there a substance present which has a substance specific concentration threshold for an aquatic risk phrase in CLP Table 3.2?														
Substance	**Specific Ecotoxicity Concentration threshold on CLP**													
Benzo(a)anthracene	R52/53 0.0025% = 25 mg/kg	0.41	0.83	0.01	0.02	0.51	0.13	1.08	2.32	2.23	0.02	0.17	0.19	0.37
Dibenzo(a,h)anthracene	R52/53 0.0025% = 25 mg/kg	0.04	0.06	0.00	0.00	0.04	0.01	0.05	0.06	0.05	0.00	0.02	0.01	0.03
Dibutyl tin	R52/53 0.025% = 250 mg/kg	0.002	0.213	0.004	0.002	0.027	0.055	0.124	0.140	0.006	0.002	0.002	0.068	0.018
Tributyl tin	R52/53 0.025% = 250 mg/kg	0.009	0.013	0.002	0.002	0.009	0.027	0.088	0.094	0.046	0.002	0.012	0.014	0.021
Any sample exceed specific concentration threshold?		No	No	No	No	No	No	No	No	No	No	No	No	No
		calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues

Step 4

Station	VC03A 0m	VC03A 0.7m	VC03A 1.24m	VC03A 1.79m	VC04 0m	VC04 1m	VC04 2m	VC04 3m	VC04 4m	VC04 4.53m	VC06 0m	VC06 1m	VC06 2m
Exclude any sample that is <1000 mg/kg													
insert data for samples with values >= 1000mg/kg													
Anthracene	0.91	2.07	0.01	0.04	0.62	0.23	4.39	9.68	10.30	0.03	0.12	0.21	0.65
Benzo(a)anthracene	0.41	0.83	0.01	0.02	0.51	0.13	1.08	2.32	2.23	0.02	0.17	0.19	0.37
Benzo(a)pyrene	0.22	0.38	0.01	0.01	0.28	0.06	0.34	0.57	0.57	0.01	0.09	0.08	0.17
Benzo(b)fluoranthene	0.36	0.49	0.01	0.01	0.46	0.12	0.31	0.47	0.43	0.02	0.16	0.18	0.26
Benzo(k)fluoranthene	0.15	0.23	0.00	0.01	0.20	0.05	0.14	0.21	0.19	0.01	0.07	0.07	0.12
Benzo(g,h,i)perylene	0.15	0.23	0.01	0.01	0.19	0.03	0.14	0.17	0.19	0.01	0.07	0.04	0.10
Chrysene	0.42	0.68	0.01	0.02	0.48	0.10	0.87	2.01	1.93	0.02	0.15	0.17	0.29
Dibenzo(a,h)anthracene	0.04	0.06	0.00	0.00	0.04	0.01	0.05	0.06	0.05	0.00	0.02	0.01	0.03
Naphthalene	1.43	2.14	0.04	0.06	1.33	0.34	12.90	21.60	23.90	0.84	0.30	0.43	1.21
Arsenic (worst case)	39.86	24.83	15.79	6.27	42.00	33.73	14.06	28.36	39.09	7.42	44.61	24.37	19.62
Cadmium (worst case)	0.84	1.03	0.09	0.03	0.55	0.74	3.14	4.55	2.30	0.10	0.59	0.30	0.55
Chromium (worst case)	163.84	156.15	53.65	118.84	154.22	162.88	1005.73	749.97	713.43	42.69	154.99	80.00	107.11
Copper (worst case)	119.36	298.39	19.82	16.78	69.25	97.62	1700.26	1857.90	769.06	45.27	65.76	37.50	113.73
Lead (worst case))	172.75	147.86	53.14	12.55	168.36	165.43	209.35	238.63	197.64	30.45	184.46	85.79	100.58
Mercury (worst case)	1.46	2.86	0.37	0.02	0.55	0.84	17.17	52.92	30.78	0.48	0.55	0.58	1.61
Nickel (worst case)	78.66	65.35	32.27	84.71	78.06	81.89	115.17	105.69	149.06	21.78	75.23	41.15	44.78
Zinc (worst case)	375.05	299.04	60.80	88.72	261.66	300.29	963.16	593.10	637.95	63.80	275.37	241.72	336.42
Any sample results >= 1000 mg/kg	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No
	calculation stops	calculation stops	calculation stops	calculation stops	calculation stops	calculation stops	calculation continues	calculation continues	calculation stops	calculation stops	calculation stops	calculation stops	calculation stops
Not Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14			NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14

Manual intervention is required for steps 5 onwards
Sum of values where worst case concentration>= 1000mg/kg

Step 5

Station	VC04 2m	VC04 3m
Add together all of the substances with the same risk phrases, where individual conc >= 1000 mg/kg remember only to add worst case conc's		
Sum of R50-53	2705.989	1857.900

Step 6

Station	VC04 2m	VC04 3m
Are any of the generic thresholds exceeded? If yes, the waste is ecotoxic, otherwise, proceed to the next step		
Is the Sum of R50-53 >= 2500 mg/kg	yes	no
Hazardous?	calculation stops Hazardous by H14	Not hazardous by H14

Conclusion

Station	VC03A 0m	VC03A 0.7m	VC03A 1.24m	VC03A 1.79m	VC04 0m	VC04 1m	VC04 2m	VC04 3m	VC04 4m	VC04 4.53m	VC06 0m	VC06 1m	VC06 2m
Is the sample hazardous by H14?	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	Hazardous by H14	Not hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14

Conclusion

Five samples possess the hazardous property H14:
VC04 2m;
VC08A 2m;
VC05 3.48m;
VC07 3m and 4.8m

VC06 3m	VC06 4.18m	VC02A 0m	VC02A 0.86m	VC08A 0m	VC08A 1m	VC08A 2m	VC08A 3m	VC08A 4m	VC08A 4.68m	VC05 0m	VC05 1m	VC05 2m	VC05 3m	VC05 3.48m	VC01A 0m	VC01A 1m	VC01A 1.6m	VC07 0m
B02	B03	B04	B05	B06	B07	B08	B09	B10	B11	B12	B13	C01	C02	C03	C04	C05	C06	C07
2.57	**4.81**	**0.26**	**0.34**	**0.37**	**3.25**	**11.30**	**4.17**	**0.38**	**0.01**	**0.28**	**0.33**	**0.81**	**3.61**	**17.70**	**0.18**	**0.11**	**0.17**	**0.19**
0.87	**1.25**	**0.38**	**0.30**	**0.35**	**1.23**	**2.53**	**1.13**	**0.21**	**0.01**	**0.31**	**0.39**	**0.61**	**1.10**	**3.85**	**0.30**	**0.21**	**0.26**	**0.18**
0.35	**0.39**	**0.20**	**0.12**	**0.15**	**0.41**	**0.61**	**0.32**	**0.07**	**0.00**	**0.16**	**0.21**	**0.32**	**0.37**	**0.85**	**0.15**	**0.12**	**0.14**	**0.11**
0.39	**0.42**	**0.35**	**0.21**	**0.31**	**0.54**	**0.57**	**0.31**	**0.10**	**0.01**	**0.28**	**0.42**	**0.44**	**0.38**	**0.81**	**0.29**	**0.20**	**0.22**	**0.17**
0.18	**0.19**	**0.16**	**0.09**	**0.13**	**0.25**	**0.25**	**0.14**	**0.04**	**0.00**	**0.13**	**0.17**	**0.19**	**0.19**	**0.35**	**0.14**	**0.09**	**0.10**	**0.08**
0.20	**0.17**	**0.17**	**0.08**	**0.10**	**0.22**	**0.23**	**0.15**	**0.08**	**0.01**	**0.13**	**0.12**	**0.30**	**0.23**	**0.33**	**0.21**	**0.11**	**0.12**	**0.10**
0.73	**1.08**	**0.38**	**0.25**	**0.29**	**1.03**	**2.20**	**0.98**	**0.19**	**0.01**	**0.30**	**0.35**	**0.59**	**1.04**	**3.41**	**0.29**	**0.20**	**0.23**	**0.16**
0.06	**0.05**	**0.04**	**0.02**	**0.02**	**0.06**	**0.06**	**0.04**	**0.02**	**0.00**	**0.03**	**0.03**	**0.08**	**0.06**	**0.09**	**0.05**	**0.03**	**0.03**	**0.02**
6.55	**11.10**	**0.67**	**0.73**	**0.63**	**4.18**	**21.20**	**6.41**	**1.09**	**0.03**	**0.51**	**0.54**	**2.41**	**7.73**	**27.20**	**0.76**	**0.35**	**0.58**	**0.27**
0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
16.20	19.80	31.20	27.10	27.50	17.00	35.20	39.30	16.10	5.26	31.30	28.20	22.80	39.20	58.90	36.80	35.10	32.90	31.30
1.88	2.54	0.39	0.53	0.59	2.19	7.52	3.26	1.53	0.05	0.51	0.58	1.07	4.69	5.04	0.34	0.39	0.40	0.58
250.00	338.00	76.80	96.10	80.70	368.00	547.00	359.00	62.30	7.32	87.20	91.10	134.00	446.00	645.00	72.80	81.60	93.60	89.30
818.00	1200.00	55.00	90.80	87.50	1690.00	1210.00	1650.00	889.00	10.40	67.30	90.50	196.00	803.00	1140.00	48.90	49.40	61.30	76.70
140.00	161.00	107.00	112.00	108.00	152.00	208.00	186.00	82.20	4.90	128.00	109.00	131.00	239.00	257.00	104.00	127.00	133.00	127.00
1.68	8.09	0.47	0.66	0.72	1.34	45.10	19.90	8.06	0.10	0.63	0.88	0.83	37.50	86.90	1.06	0.51	0.59	0.76
69.50	65.20	34.10	39.90	35.10	69.30	41.00	38.00	22.20	4.90	38.60	38.80	52.50	42.60	39.20	32.80	36.00	39.90	39.90
540.00	819.00	173.00	200.00	229.00	602.00	835.00	594.00	226.00	17.00	218.00	242.00	338.00	842.00	1140.00	171.00	182.00	193.00	246.00
24.83	30.35	47.83	41.54	42.16	26.06	53.96	60.25	24.68	8.06	47.98	43.23	34.95	60.09	90.29	56.41	53.81	50.44	47.98
2.15	2.90	0.44	0.61	0.67	2.50	8.60	3.73	1.75	0.05	0.58	0.66	1.22	5.36	5.76	0.39	0.44	0.45	0.66
480.75	649.97	147.69	184.80	155.19	707.66	1051.88	690.36	119.80	14.08	167.69	175.19	257.68	857.66	1240.34	139.99	156.92	179.99	171.72
921.07	1351.20	61.93	102.24	98.53	1902.94	1362.46	1857.90	1001.01	11.71	75.78	101.90	220.70	904.18	1283.64	55.06	55.62	69.02	86.36
204.96	235.70	156.65	163.97	158.11	222.53	304.51	272.30	120.34	7.17	187.39	159.58	191.78	349.90	376.25	152.26	185.93	194.71	185.93
1.81	8.74	0.50	0.71	0.78	1.45	48.71	21.49	8.70	0.11	0.68	0.95	0.89	40.50	93.85	1.14	0.55	0.63	0.82
140.18	131.51	68.78	80.48	70.80	139.78	82.70	76.65	44.78	9.88	77.86	78.26	105.89	85.92	79.07	66.16	72.61	80.48	80.48
672.84	1020.47	215.56	249.20	285.33	750.09	1040.41	740.12	281.60	21.18	271.63	301.53	421.15	1049.13	1420.44	213.07	226.77	240.48	306.52

VC06 3m	VC06 4.18m	VC02A 0m	VC02A 0.86m	VC08A 0m	VC08A 1m	VC08A 2m	VC08A 3m	VC08A 4m	VC08A 4.68m	VC05 0m	VC05 1m	VC05 2m	VC05 3m	VC05 3.48m	VC01A 0m	VC01A 1m	VC01A 1.6m	VC07 0m
No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
0.87	1.25	0.38	0.30	0.35	1.23	2.53	1.13	0.21	0.01	0.31	0.39	0.61	1.10	3.85	0.30	0.21	0.26	0.18
0.06	0.05	0.04	0.02	0.02	0.06	0.06	0.04	0.02	0.00	0.03	0.03	0.08	0.06	0.09	0.05	0.03	0.03	0.02
0.374	0.285	0.002	0.048	0.057	0.325	0.261	0.026	0.009	0.002	0.002	0.002	0.019	0.169	0.208	0.005	0.012	0.008	0.012
0.047	0.078	0.012	0.021	0.008	0.122	0.138	0.021	0.002	0.002	0.010	0.016	0.027	0.037	0.094	0.011	0.023	0.026	0.008
No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues	calculation continues

VC06 3m	VC06 4.18m	VC02A 0m	VC02A 0.86m	VC08A 0m	VC08A 1m	VC08A 2m	VC08A 3m	VC08A 4m	VC08A 4.68m	VC05 0m	VC05 1m	VC05 2m	VC05 3m	VC05 3.48m	VC01A 0m	VC01A 1m	VC01A 1.6m	VC07 0m
2.57	4.81	0.26	0.34	0.37	3.25	11.30	4.17	0.38	0.01	0.28	0.33	0.81	3.61	17.70	0.18	0.11	0.17	0.19
0.87	1.25	0.38	0.30	0.35	1.23	2.53	1.13	0.21	0.01	0.31	0.39	0.61	1.10	3.85	0.30	0.21	0.26	0.18
0.35	0.39	0.20	0.12	0.15	0.41	0.61	0.32	0.07	0.00	0.16	0.21	0.32	0.37	0.85	0.15	0.12	0.14	0.11
0.39	0.42	0.35	0.21	0.31	0.54	0.57	0.31	0.10	0.01	0.28	0.42	0.44	0.38	0.81	0.29	0.20	0.22	0.17
0.18	0.19	0.16	0.09	0.13	0.25	0.25	0.14	0.04	0.00	0.13	0.17	0.19	0.19	0.35	0.14	0.09	0.10	0.08
0.20	0.17	0.17	0.08	0.10	0.22	0.23	0.15	0.08	0.01	0.13	0.12	0.30	0.23	0.33	0.21	0.11	0.12	0.10
0.73	1.08	0.38	0.25	0.29	1.03	2.20	0.98	0.19	0.01	0.30	0.35	0.59	1.04	3.41	0.29	0.20	0.23	0.16
0.06	0.05	0.04	0.02	0.02	0.06	0.06	0.04	0.02	0.00	0.03	0.03	0.08	0.06	0.09	0.05	0.03	0.03	0.02
6.55	11.10	0.67	0.73	0.63	4.18	21.20	6.41	1.09	0.03	0.51	0.54	2.41	7.73	27.20	0.76	0.35	0.58	0.27
24.83	30.35	47.83	41.54	42.16	26.06	53.96	60.25	24.68	8.06	47.98	43.23	34.95	60.09	90.29	56.41	53.81	50.44	47.98
2.15	2.90	0.44	0.61	0.67	2.50	8.60	3.73	1.75	0.05	0.58	0.66	1.22	5.36	5.76	0.39	0.44	0.45	0.66
480.75	649.97	147.69	184.80	155.19	707.66	1051.88	690.36	119.80	14.08	167.69	175.19	257.68	857.66	1240.34	139.99	156.92	179.99	171.72
921.07	1351.20	61.93	102.24	98.53	1902.94	1362.46	1857.90	1001.01	11.71	75.78	101.90	220.70	904.18	1283.64	55.06	55.62	69.02	86.36
204.96	235.70	156.65	163.97	158.11	222.53	304.51	272.30	120.34	7.17	187.39	159.58	191.78	349.90	376.25	152.26	185.93	194.71	185.93
1.81	8.74	0.50	0.71	0.78	1.45	48.71	21.49	8.70	0.11	0.68	0.95	0.89	40.50	93.85	1.14	0.55	0.63	0.82
140.18	131.51	68.78	80.48	70.80	139.78	82.70	76.65	44.78	9.88	77.86	78.26	105.89	85.92	79.07	66.16	72.61	80.48	80.48
672.84	1020.47	215.56	249.20	285.33	750.09	1040.41	740.12	281.60	21.18	271.63	301.53	421.15	1049.13	1420.44	213.07	226.77	240.48	306.52
No	Yes	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No
calculation stops	calculation continues	calculation stops	calculation stops	calculation stops	calculation continues	calculation continues	calculation continues	calculation continues	calculation stops	calculation stops	calculation stops	calculation stops	calculation continues	calculation continues	calculation stops	calculation stops	calculation stops	calculation stops
NOT Hazardous by H14		NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14					NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14			NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14

VC06 4.18m	VC08A 1m	VC08A 2m	VC08A 3m	VC08A 4m	VC05 3m	VC05 3.48m
2371.674	1902.940	3454.751	1857.900	1001.014	1049.132	3944.415

VC06 4.18m	VC08A 1m	VC08A 2m	VC08A 3m	VC08A 4m	VC05 3m	VC05 3.48m
no	no	yes	no	no	no	yes
Not hazardous by H14	Not hazardous by H14	calculation stops	Not hazardous by H14	Not hazardous by H14	Not hazardous by H14	calculation stops
		Hazardous by H14				Hazardous by H14

VC06 3m	VC06 4.18m	VC02A 0m	VC02A 0.86m	VC08A 0m	VC08A 1m	VC08A 2m	VC08A 3m	VC08A 4m	VC08A 4.68m	VC05 0m	VC05 1m	VC05 2m	VC05 3m	VC05 3.48m	VC01A 0m	VC01A 1m	VC01A 1.6m	VC07 0m
NOT Hazardous by H14	Not hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	Not hazardous by H14	Hazardous by H14	Not hazardous by H14	Not hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	Not hazardous by H14	Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14	NOT Hazardous by H14

VC07 1m	VC07 2m	VC07 3m	VC07 4m	VC07 4.87m	VC05A 3.78m
C08	C09	C10	C11	C12	C13
10.90	**2.34**	**5.44**	**8.50**	**11.40**	**7.38**
3.28	**0.90**	**1.03**	**2.20**	**2.14**	**1.71**
1.08	**0.31**	**0.22**	**0.61**	**0.49**	**0.46**
1.01	**0.42**	**0.27**	**0.59**	**0.45**	**0.39**
0.46	**0.19**	**0.11**	**0.26**	**0.20**	**0.17**
0.47	**0.21**	**0.09**	**0.28**	**0.19**	**0.17**
2.78	**0.84**	**0.92**	**1.96**	**1.85**	**1.51**
0.19	**0.05**	**0.03**	**0.07**	**0.05**	**0.05**
19.90	**7.72**	**12.60**	**30.20**	**18.00**	**8.81**
0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
14.90	25.00	24.70	41.90	32.10	30.00
2.29	2.07	2.67	4.12	5.45	4.52
279.00	301.00	560.00	445.00	569.00	588.00
939.00	827.00	1540.00	926.00	1870.00	1200.00
145.00	188.00	118.00	252.00	195.00	172.00
1.37	4.65	14.80	34.60	52.00	69.90
68.50	51.70	45.50	37.40	39.10	38.20
579.00	557.00	704.00	874.00	883.00	753.00
22.84	38.33	37.87	64.23	49.21	45.99
2.62	2.37	3.05	4.71	6.23	5.17
536.52	578.82	1076.88	855.74	1094.19	1130.72
1057.31	931.20	1734.04	1042.68	2105.62	1351.20
212.28	275.23	172.75	368.93	285.48	251.81
1.48	5.02	15.98	37.37	56.16	75.49
138.16	104.28	91.77	75.44	78.86	77.05
721.43	694.02	877.18	1089.00	1100.22	938.24

VC07 1m	VC07 2m	VC07 3m	VC07 4m	VC07 4.87m	VC05A 3.78m
No	No	No	No	No	No
3.28	0.90	1.03	2.20	2.14	1.71
0.19	0.05	0.03	0.07	0.05	0.05
0.137	0.190	0.317	0.651	0.042	0.048
0.092	0.054	0.513	0.098	0.064	0.040
No	No	No	No	No	No
calculation continues	calculation continues	alculation continue	calculation continues	calculation continues	calculation continues

VC07 1m	VC07 2m	VC07 3m	VC07 4m	VC07 4.87m	VC05A 3.78m
10.90	2.34	5.44	8.50	11.40	7.38
3.28	0.90	1.03	2.20	2.14	1.71
1.08	0.31	0.22	0.61	0.49	0.46
1.01	0.42	0.27	0.59	0.45	0.39
0.46	0.19	0.11	0.26	0.20	0.17
0.47	0.21	0.09	0.28	0.19	0.17
2.78	0.84	0.92	1.96	1.85	1.51
0.19	0.05	0.03	0.07	0.05	0.05
19.90	7.72	12.60	30.20	18.00	8.81
22.84	38.33	37.87	64.23	49.21	45.99
2.62	2.37	3.05	4.71	6.23	5.17
536.52	578.82	1076.88	855.74	1094.19	1130.72
1057.31	931.20	1734.04	1042.68	2105.62	1351.20
212.28	275.23	172.75	368.93	285.48	251.81
1.48	5.02	15.98	37.37	56.16	75.49
138.16	104.28	91.77	75.44	78.86	77.05
721.43	694.02	877.18	1089.00	1100.22	938.24
Yes	No	Yes	Yes	Yes	Yes
calculation continues	calculation stops	alculation continue	calculation continues	calculation continues	calculation continues
	NOT Hazardous by H14				

VC07 1m	VC07 3m	VC07 4m	VC07 4.87m	VC05A 3.78m
1057.314	2810.920	2131.680	4300.025	2481.924

VC07 1m	VC07 3m	VC07 4m	VC07 4.87m	VC05A 3.78m
no	yes	no	yes	no
Not hazardous by H14	calculation stops	Not hazardous by H14	calculation stops	Not hazardous by H14
	Hazardous by H14		Hazardous by H14	

VC07 1m	VC07 2m	VC07 3m	VC07 4m	VC07 4.87m	VC05A 3.78m
Not hazardous by H14	NOT Hazardous by H14	Hazardous by H14	Not hazardous by H14	Hazardous by H14	Not hazardous by H14

Summary of Chemical Analysis
Sediment Samples
Ref: J-2646

			Station	VC03A 0m	VC03A 0.7m	VC03A 1.24m	VC03A 1.79m	VC04 0m	VC04 1m	VC04 2m	VC04 3m
			Lab ID	A01	A02	A03	A04	A05	A06	A07	A08
	Units										
Total Hydrocabons	mg/kg			1120	937	9.1	52.1	627	231	2010	2910
Naphthalene	µg/kg	34.6	391	1430	2140	36.4	61.9	1330	335	12900	21600
Acenaphthylene	µg/kg	5.87	128	1420	3270	15.0	87.5	683	196	7390	14100
Acenaphthene	µg/kg	6.71	88.9	456	497	5.7	13.8	363	68.6	3030	5360
Fluorene	µg/kg	21.2	144	1170	1580	15.4	36.7	706	170	6950	13600
Phenanthrene	µg/kg	86.7	544	2490	2950	44.1	73.2	2020	465	14000	31400
Anthracene	µg/kg	46.9	245	909	2070	13.5	38.8	622	225	4390	9680
Fluoranthene	µg/kg	113	1494	1280	1830	22.9	39.4	1350	370	2550	5100
Pyrene	µg/kg	153	1398	1330	2230	27.0	40.9	1270	360	3550	7860
Benzo(a)anthracene	µg/kg	74.8	693	412	825	12.4	18.1	508	132	1080	2320
Chrysene	µg/kg	108	846	419	675	10.5	17.4	481	103	873	2010
Benzo(b)fluoranthene	µg/kg			355	491	9.8	14.2	464	119	311	474
Benzo(k)fluoranthene	µg/kg			154	225	4.3	5.5	199	48.0	139	212
Benzo(a)pyrene	µg/kg	88.8	763	222	375	6.6	9.2	275	60.5	336	565
Indeno(123cd)pyrene	µg/kg			135	191	6.1	9.8	157	28.6	104	133
Benzo(ghi)perylene	µg/kg			152	231	7.7	12.4	190	27.1	136	166
Dibenzo(ah)anthracene	µg/kg	6.22	135	37.5	62.3	1.7	2.3	40.7	6.9	45.1	57.5
Total EPA16 Priority PAH	µg/kg			12400	19600	239	481	10700	2720	57800	115000
C1 Naphthalenes	µg/kg			5380	9480	127	325	4640	884	35300	70200
C2 Naphthalenes	µg/kg			5970	8040	137	340	6430	1150	23400	50800
C3 Naphthalenes	µg/kg			3470	4280	92	186	4540	937	8480	18100
C1 Phenanthrenes	µg/kg			3400	5010	57	112	2640	690	18400	41100
Benzo(e)pyrene	µg/kg			214	284	6.3	9.2	281	63.8	196	325
Perylene	µg/kg			65.0	95.8	2.0	2.7	76.0	19.3	63.2	99.8
DBT	µg/kg	100	1000	2	213	4.26	2	27.4	54.5	124	140
TBT	µg/kg	100	1000	9.17	12.5	2	2	8.59	27.1	88.0	94.3
TOC	%			11.0	4.80	0.65	0.23	7.07	4.12	6.60	5.47
Mean diameter (X)	µm			33	62	884	97	19	22	20	16
Mean diameter (X)	ø			4.91	4.02	0.18	3.37	5.72	5.54	5.61	5.99
Standard deviation (S)	ø			2.25	2.95	2.91	3.17	2.05	2.13	2.35	2.20
Skewness (Skq)	ø			0.17	-0.25	0.87	0.42	0.12	0.11	0.04	-0.18
Silt/clay	%			63.8	54.3	9.17	40.0	78.9	75.0	72.7	82.0
Silt	%			54.5	46.6	7.17	29.8	64.9	61.6	55.7	63.4
Clay	%			9.26	7.70	2.00	10.2	14.1	13.4	16.9	18.6
Wentworth scale	N/A			Very coarse s	Very coarse s	Very coarse s	Very fine san	Coarse silt	Coarse silt	Coarse silt	Medium silt
Sorting index	N/A			Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s
Mercury	mg/kg	0.3	3	1.35	2.65	0.339	0.0207	0.508	0.774	15.9	49.0
Arsenic	mg/kg	20	100	26.0	16.2	10.3	4.09	27.4	22.0	9.17	18.5
Cadmium	mg/kg	0.4	5	0.734	0.902	0.077	0.024	0.481	0.651	2.75	3.98
Chromium	mg/kg	40	400	85.2	81.2	27.9	61.8	80.2	84.7	523	390
Copper	mg/kg	40	400	106	265	17.6	14.9	61.5	86.7	1510	1650
Lead	mg/kg	50	500	118	101	36.3	8.57	115	113	143	163
Nickel	mg/kg	20	200	39.0	32.4	16.0	42.0	38.7	40.6	57.1	52.4
Zinc	mg/kg	130	800	301	240	48.8	71.2	210	241	773	476
PCB18	µg/kg			<0.1	1.59	0.375	0.381	1.00	3.87	18.5	97.4
PCB28	µg/kg			1.46	1.80	0.383	0.395	0.955	3.83	8.16	79.7
PCB31	µg/kg			3.44	1.57	0.343	0.336	4.44	2.59	6.11	32.0
PCB44	µg/kg			<0.1	<0.1	0.073	<0.05	<0.05	0.782	<0.1	3.37
PCB47	µg/kg			<0.1	0.911	0.077	0.050	<0.05	0.617	0.695	0.390
PCB49	µg/kg			<0.1	0.118	0.118	0.065	0.088	<0.1	<0.1	1.61
PCB52	µg/kg			<0.1	2.35	0.083	0.060	0.480	0.595	1.14	32.0
PCB66	µg/kg			0.720	0.322	0.075	0.076	0.364	1.01	0.404	1.57
PCB101	µg/kg			0.648	0.686	<0.05	<0.05	0.444	0.933	0.594	0.213
PCB105	µg/kg			0.123	<0.1	<0.05	<0.05	0.112	0.309	0.117	0.439
PCB110	µg/kg			0.746	1.18	<0.05	<0.05	0.812	1.23	2.17	0.891
PCB118	µg/kg			0.629	0.215	0.090	0.145	0.415	3.01	0.968	1.48
PCB128	µg/kg			0.319	0.419	<0.05	<0.05	0.193	0.320	0.205	3.41
PCB138	µg/kg			0.226	0.692	<0.05	0.054	<0.05	1.67	1.65	10.2
PCB141	µg/kg			<0.1	<0.1	<0.05	<0.05	<0.05	0.394	0.242	1.13
PCB149	µg/kg			<0.1	0.619	<0.05	<0.05	0.183	0.507	1.03	0.485
PCB151	µg/kg			0.144	<0.1	<0.05	<0.05	0.056	0.428	<0.1	0.114
PCB153	µg/kg			0.798	0.522	<0.05	<0.05	0.422	0.876	0.363	1.02
PCB156	µg/kg			<0.1	<0.1	<0.05	<0.05	0.063	0.141	0.172	<0.1
PCB158	µg/kg			<0.1	<0.1	<0.05	<0.05	<0.05	1.27	<0.1	0.292
PCB170	µg/kg			<0.1	0.175	<0.05	<0.05	0.128	0.152	0.309	1.53
PCB180	µg/kg			0.603	0.463	<0.05	<0.05	0.295	0.451	0.306	0.146
PCB183	µg/kg			<0.1	0.158	<0.05	<0.05	<0.05	0.215	0.102	0.590
PCB187	µg/kg			<0.1	0.264	<0.05	<0.05	0.153	0.649	<0.1	<0.1
PCB194	µg/kg			0.285	0.102	<0.05	<0.05	<0.05	0.114	0.103	<0.1
$\sum$ ICES 7	µg/kg	10		4.14	6.73	0.556	0.654	3.01	11.4	13.2	125
$\sum$ 25 CONGENERS	µg/kg	20	200	9.92	14.2	1.62	1.56	10.6	26.0	43.3	270
alpha-HCH	µg/kg			<0.4	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
beta-HCH	µg/kg			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-HCH (Lindane)	µg/kg			1.44	0.274	<0.1	<0.1	0.520	0.175	<0.1	<0.1
Dieldrin	µg/kg			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene	µg/kg			5.34	4.98	0.603	0.664	2.76	2.83	31.8	279
pp-DDE	µg/kg			2.38	1.10	<0.1	<0.1	1.13	1.00	1.72	2.36
pp-DDT	µg/kg	1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
pp-TDE	µg/kg			2.03	0.971	<0.1	<0.1	1.49	0.890	1.14	<0.1

VC04 4m	VC04 4.53m	VC06 0m	VC06 1m	VC06 2m	VC06 3m	VC06 4.18m	VC02A 0m	VC02A 0.86	VC08A 0m	VC08A 1m	VC08A 2m	VC08A 3m	VC08A 4m
A09	A10	A11	A12	B01	B02	B03	B04	B05	B06	B07	B08	B09	B10
3910	54.8	148	249	523	1420	2040	296	272	418	1820	3250	1740	236
23900	844	299	433	1210	6550	11100	665	725	628	4180	21200	6410	1090
13300	27.2	93.9	201	787	4030	7600	230	392	470	4790	13900	4870	271
6100	63.0	68.3	102	309	1640	3900	159	139	150	1800	7510	2010	146
15100	103	115	196	589	3330	7150	299	306	344	3630	15800	4720	349
33900	242	461	715	1370	7470	14700	1180	1040	1080	8850	35200	11700	823
10300	34.6	124	214	650	2570	4810	261	337	373	3250	11300	4170	377
5280	73.9	406	501	841	1920	2970	818	637	877	2660	6080	2640	459
8590	71.1	351	455	797	2360	3970	726	651	804	3080	9200	3720	473
2230	24.2	171	186	365	867	1250	382	300	353	1230	2530	1130	208
1930	23.3	152	167	289	727	1080	383	245	290	1030	2200	976	190
428	16.4	157	179	261	393	423	349	213	309	542	570	314	97.7
189	6.8	72.7	71.4	116	180	185	157	94.3	132	249	253	142	39.8
570	11.2	91.8	81.8	166	347	392	198	117	150	409	609	321	71.3
119	3.7	56.9	40.0	84.6	150	135	127	61.6	90.5	190	164	97.4	63.3
188	5.0	72.8	38.2	96.4	196	168	174	77.8	96.6	224	228	149	78.7
52.9	1.2	16.5	9.5	25.1	58.4	54.0	39.5	18.6	23.0	64.9	63.3	35.8	16.1
122000	1550	2710	3590	7950	32800	59900	6150	5360	6170	36200	127000	43400	4750
78300	1050	819	1240	2670	16800	32700	2840	2210	1900	13700	72000	19200	3950
58000	731	1220	1830	3610	15100	26300	4560	3680	3430	15600	65500	19100	2450
21800	372	1100	1680	2390	6560	10000	3670	2750	2660	7800	24500	8560	1600
44200	277	585	929	1950	7990	14300	1440	1380	1450	12100	46500	15900	823
347	14.1	81.9	84.6	138	234	245	195	105	136	262	386	213	71.7
98.5	4.0	26.4	27.6	48.8	77.7	79.6	52.7	31.4	46.3	96.4	110	67.0	18.1
5.95	2	2	67.9	18.3	374	285	2	48.0	56.5	325	261	26.0	8.61
46.4	2	11.6	14.2	21.2	46.8	77.7	11.7	21.4	7.51	122	138	20.6	2
5.74	1.90	4.48	6.65	4.37	7.01	7.35	6.20	6.37	11.1	8.20	6.74	4.73	2.08
14	149	16	19	21	15	16	18	15	28	17	15	17	169
6.11	2.75	5.93	5.69	5.60	6.03	6.01	5.80	6.01	5.15	5.89	6.02	5.92	2.56
2.19	1.91	1.97	1.99	2.26	2.07	2.08	2.03	2.19	2.19	2.01	2.04	2.31	2.23
-0.04	1.19	0.16	0.28	-0.02	-0.04	-0.07	0.10	-0.10	0.19	0.08	0.00	-0.05	1.58
82.0	10.6	83.0	79.9	75.9	83.7	83.6	79.8	81.6	67.0	82.2	83.6	77.8	17.7
61.4	7.26	67.5	66.3	60.8	66.7	66.6	65.3	62.7	56.3	67.3	66.3	58.1	13.2
20.6	3.38	15.5	13.6	15.1	17.0	17.1	14.6	18.9	10.7	14.9	17.3	19.7	4.53
Medium silt	Fine sand	Coarse silt	Coarse silt	Coarse silt	Medium silt	Medium silt	Coarse silt	Medium silt	Coarse silt	Coarse silt	Medium silt	Coarse silt	Fine sand
Very poorly s	Poorly sorte	Poorly sorted	Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s	Very poorly s
28.5	0.443	0.507	0.538	1.49	1.68	8.09	0.467	0.657	0.72	1.34	45.1	19.9	8.06
25.5	4.84	29.1	15.9	12.8	16.2	19.8	31.2	27.1	27.5	17.0	35.2	39.3	16.1
2.01	0.084	0.517	0.264	0.478	1.88	2.54	0.389	0.533	0.590	2.19	7.52	3.26	1.53
371	22.2	80.6	41.6	55.7	250	338	76.8	96.1	80.7	368	547	359	62.3
683	40.2	58.4	33.3	101	818	1200	55.0	90.8	87.5	1690	1210	1650	889
135	20.8	126	58.6	68.7	140	161	107	112	108	152	208	186	82.2
73.9	10.8	37.3	20.4	22.2	69.5	65.2	34.1	39.9	35.1	69.3	41.0	38.0	22.2
512	51.2	221	194	270	540	819	173	200	229	602	835	594	226
2.68	0.345	1.61	1.63	3.08	1.73	14.4	1.22	2.41	1.52	4.26	43.3	3.39	1.61
2.92	0.419	2.04	2.07	3.52	2.12	14.3	1.30	2.58	2.20	7.29	33.8	4.21	2.56
7.17	0.394	3.78	2.19	2.65	3.00	5.45	1.77	2.02	0.536	7.08	9.05	5.17	1.28
0.834	0.091	<0.1	1.07	2.40	<0.1	<0.1	<0.1	<0.1	0.151	1.10	<0.1	0.715	0.497
0.566	0.162	0.393	0.529	0.733	0.880	0.165	0.220	0.861	<0.1	3.20	2.15	0.306	0.247
0.525	0.165	0.394	0.136	<0.1	0.166	<0.1	0.165	<0.1	<0.1	0.470	<0.1	0.734	<0.1
1.56	0.270	0.572	0.551	0.517	0.459	0.279	0.405	0.737	0.333	0.804	1.18	1.90	1.92
1.11	0.187	1.16	0.791	0.972	0.214	0.354	0.658	0.882	0.788	1.11	0.816	1.10	1.19
1.19	0.208	0.967	0.788	0.816	0.760	0.485	0.644	0.903	0.200	0.674	<0.1	2.45	1.25
0.525	0.054	0.349	0.224	0.208	<0.1	<0.1	0.220	0.264	0.201	0.197	0.197	0.334	0.300
2.39	0.256	1.33	0.981	1.30	2.12	1.16	0.942	1.39	0.645	2.07	0.246	2.31	1.25
3.28	0.579	2.56	2.27	2.83	0.450	0.474	1.96	2.14	2.39	0.378	0.710	2.02	2.48
2.02	<0.05	0.278	0.229	0.265	<0.1	<0.1	0.319	0.354	0.180	0.119	0.435	0.816	0.238
5.16	0.238	1.33	1.26	1.44	0.684	1.42	1.02	1.46	1.25	0.208	2.72	1.67	0.123
0.140	<0.05	0.118	0.110	0.162	<0.1	0.435	0.172	<0.1	0.733	<0.1	1.02	0.155	0.107
4.97	0.116	0.522	0.275	0.232	<0.1	<0.1	0.314	0.797	0.186	0.827	0.319	2.14	0.467
0.134	<0.05	0.250	0.270	0.281	<0.1	<0.1	0.152	0.270	0.110	0.180	<0.1	0.533	0.142
5.61	0.158	0.927	0.705	0.796	0.623	0.132	0.636	0.836	0.618	0.294	0.404	2.95	0.941
0.164	<0.05	0.126	0.134	0.135	<0.1	0.142	0.163	0.138	0.107	<0.1	<0.1	0.151	0.109
0.771	<0.05	0.990	1.06	1.19	<0.1	<0.1	0.826	1.03	1.13	<0.1	<0.1	0.323	0.511
0.243	<0.05	<0.1	0.189	0.133	<0.1	0.260	0.188	0.192	<0.1	<0.1	0.903	0.321	0.182
0.780	0.058	0.251	0.304	0.355	0.261	0.282	0.376	0.430	0.347	0.309	0.339	0.837	0.418
0.250	<0.05	0.681	0.151	<0.1	<0.1	<0.1	0.178	<0.1	<0.1	<0.1	0.167	0.215	0.154
0.217	<0.05	0.234	0.377	0.386	0.107	0.107	0.262	0.790	0.405	0.179	0.150	0.359	<0.1
0.183	<0.05	<0.1	0.102	0.159	<0.1	<0.1	<0.1	0.102	<0.1	<0.1	0.321	0.204	0.132
20.5	1.93	8.65	7.95	10.3	5.36	17.4	6.34	9.09	7.34	9.96	39.2	16.0	9.69
45.4	3.70	20.9	18.4	24.6	13.6	39.8	14.1	20.6	14.0	30.8	98.2	35.3	18.1
<0.1	<0.1	<0.1	0.126	0.118	<0.1	<0.1	0.112	0.144	<0.2	<0.1	<0.1	<0.1	<0.1
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<0.1	<0.1	0.125	0.125	0.120	<0.1	<0.1	<0.1	0.155	0.200	<0.1	<0.1	0.241	<0.1
<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
50.6	<0.5	2.10	1.77	4.47	11.1	36.8	1.79	2.24	2.63	19.1	193	10.9	12.4
1.96	0.118	1.18	1.34	1.32	1.31	1.77	1.19	1.45	1.25	1.88	2.00	2.37	2.72
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
0.999	<0.1	1.43	1.24	1.19	<0.1	<0.1	1.30	1.55	1.43	0.930	<0.1	<0.1	3.51

VC08A 4.68	VC05 0m	VC05 1m	VC05 2m	VC05 3m	VC05 3.48	VC01A 0m	VC01A 1m	VC01A 1.6	VC07 0m	VC07 1m	VC07 2m	VC07 3m	VC07 4m	VC07 4.87	VC05A 3.7
B11	B12	B13	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13
11.8	305	622	1200	1850	6690	117	139	208	224	3160	2020	3720	4070	3180	1540
33.9	514	540	2410	7730	27200	760	350	581	273	19900	7720	12600	30200	18000	8810
14.7	258	262	1100	4200	22600	174	91.6	151	283	17900	3000	8120	11000	13000	9600
8.0	157	148	434	1550	6930	154	93.9	145	82.6	6800	2290	3740	6220	7050	2660
15.5	264	237	1020	4110	20100	215	134	208	166	15400	3460	7500	13100	15300	7910
44.5	937	955	2620	9840	49400	826	534	785	443	33400	7180	14600	27000	35600	20900
10.9	279	334	810	3610	17700	175	114	171	186	10900	2340	5440	8500	11400	7380
15.4	710	1010	1190	2560	8830	574	425	534	389	6710	2750	2880	5550	5230	3470
19.4	645	839	1200	3400	13200	492	366	469	363	9410	2810	3680	7800	8210	5440
8.3	314	390	610	1100	3850	301	214	262	183	3280	897	1030	2200	2140	1710
8.3	301	347	594	1040	3410	290	202	226	163	2780	843	918	1960	1850	1510
6.4	280	417	442	384	805	288	196	218	172	1010	419	265	586	450	387
1.9	129	174	194	185	345	140	92.9	101	81.5	463	194	114	258	199	174
3.7	158	209	318	371	851	148	124	135	108	1080	310	223	609	490	463
4.6	99.1	125	201	148	200	149	85.0	86.0	75.8	394	153	64.6	176	120	118
11.1	125	120	297	232	331	206	113	118	96.5	465	214	92.9	284	188	173
1.0	28.3	29.7	80.1	55.3	88.8	48.9	26.7	25.9	23.2	192	49.9	25.3	67.9	51.1	49.8
208	5200	6140	13500	40500	176000	4940	3160	4220	3090	130000	34600	61300	115000	119000	70700
82	1540	1540	9050	27500	116000	3020	1300	2250	1090	74200	18200	45300	101000	85600	38700
122	2720	2660	7840	21400	94800	5040	1990	3440	1410	50900	14300	30200	73000	64700	34900
95	2070	1990	5500	9730	35400	4080	1620	2730	1120	14800	6680	10300	28700	23400	13900
56	1220	1290	3430	13400	67100	1000	648	956	629	44300	9520	20000	35500	47000	28300
5.1	139	185	250	256	588	120	101	120	87.7	540	246	178	405	342	272
1.8	45.5	69.2	79.4	75.9	152	37.6	39.6	35.7	30.2	177	73.8	46.8	111	90.1	78.5
2	2	2	19.4	169	208	4.68	12.0	8.34	11.7	137	190	317	651	42.2	48.3
2	9.71	16.3	27.1	37.1	93.6	10.5	23.2	25.7	8.49	92.4	54.3	513	98.2	63.8	39.8
0.35	5.01	4.43	5.14	4.24	7.19	6.08	6.52	6.02	5.73	6.56	5.49	2.52	5.83	6.82	4.37
853	19	22	16	13	15	17	17	12	20	22	18	13	16	15	14
0.23	5.69	5.48	5.99	6.23	6.02	5.86	5.87	6.42	5.63	5.51	5.78	6.24	5.97	6.09	6.19
2.08	1.94	1.95	2.10	2.19	1.96	1.99	2.01	1.95	1.96	2.02	2.13	2.00	1.99	2.06	2.16
0.13	0.18	0.25	0.03	-0.13	0.04	0.17	0.15	0.01	0.26	0.07	-0.05	-0.12	0.05	0.01	-0.04
2.74	79.7	76.0	82.1	83.8	85.8	81.4	81.7	89.3	77.8	77.8	78.7	87.6	84.4	84.6	83.3
2.26	67.3	65.3	64.6	61.8	69.9	66.5	66.3	67.5	65.5	66.8	63.6	68.9	68.5	66.1	62.0
0.48	12.4	10.8	17.5	22.0	15.9	14.9	15.4	21.8	12.3	11.0	15.1	18.7	15.9	18.5	21.4
Coarse sand	Coarse silt	Coarse silt	Coarse silt	Medium sil	Medium sil	Coarse silt	Coarse silt	Medium sil	Coarse silt	Coarse silt	Coarse silt	Medium sil	Coarse silt	Medium sil	Medium sil
Poorly sorte	Poorly sorted	Poorly sorted	Very poorly	Very poorly	Poorly sort	Very poorly	Very poorly	Poorly sort	Poorly sort	Very poorly	Very poorly	Very poorly	Very poorly	Very poorly	Very poorly
0.0987	0.632	0.878	0.826	37.5	86.9	1.06	0.509	0.586	0.759	1.37	4.65	14.8	34.6	52.0	69.9
5.26	31.3	28.2	22.8	39.2	58.9	36.8	35.1	32.9	31.3	14.9	25.0	24.7	41.9	32.1	30.0
0.045	0.510	0.579	1.07	4.69	5.04	0.338	0.389	0.396	0.581	2.29	2.07	2.67	4.12	5.45	4.52
7.32	87.2	91.1	134	446	645	72.8	81.6	93.6	89.3	279	301	560	445	569	588
10.4	67.3	90.5	196	803	1140	48.9	49.4	61.3	76.7	939	827	1540	926	1870	1200
4.90	128	109	131	239	257	104	127	133	127	145	188	118	252	195	172
4.90	38.6	38.8	52.5	42.6	39.2	32.8	36.0	39.9	39.9	68.5	51.7	45.5	37.4	39.1	38.2
17.0	218	242	338	842	1140	171	182	193	246	579	557	704	874	883	753
0.106	0.818	1.29	1.15	21.9	2.18	1.21	1.43	1.80	0.945	2.34	5.80	<0.1	<0.1	18.1	3.12
0.091	1.08	2.74	1.37	7.86	2.79	1.19	1.53	1.81	1.05	1.22	2.78	17.9	116	10.7	4.66
0.096	2.18	2.40	1.51	2.72	4.34	2.04	1.96	1.95	1.86	1.50	1.44	3.60	34.7	10.3	4.26
<0.05	<0.1	1.55	<0.1	<0.1	0.513	<0.1	<0.1	<0.1	0.134	0.204	<0.1	<0.1	<0.1	<0.1	2.22
0.076	0.309	0.514	<0.1	<0.1	0.121	0.261	0.320	0.407	0.226	<0.1	<0.1	<0.1	<0.1	2.49	1.40
<0.05	0.122	0.175	<0.1	0.222	0.244	0.200	0.220	<0.1	0.148	0.145	0.165	<0.1	<0.1	<0.1	1.16
<0.05	0.833	0.370	0.788	0.300	0.996	0.438	0.362	0.386	0.321	0.444	2.91	<0.1	1.88	0.695	1.63
<0.05	0.394	0.828	0.254	1.01	0.726	0.833	0.832	0.861	0.370	0.356	0.192	0.762	2.29	0.652	2.38
<0.05	0.616	1.21	0.601	0.228	0.991	0.862	0.694	0.857	0.674	1.82	0.419	7.55	5.41	0.334	1.84
<0.05	0.122	0.291	0.245	0.165	0.325	0.340	0.258	0.260	0.129	<0.1	0.196	<0.1	<0.1	0.202	0.621
<0.05	0.612	1.98	1.01	0.928	1.64	1.05	1.10	1.33	0.702	3.26	0.564	<0.1	<0.1	0.966	2.70
0.051	0.519	2.92	0.308	2.42	2.02	2.33	2.35	2.21	0.463	0.807	1.05	2.07	4.02	2.56	2.36
<0.05	0.235	0.371	1.78	0.326	0.619	0.288	0.176	0.222	0.189	<0.1	0.603	1.25	<0.1	<0.1	1.87
<0.05	0.290	1.47	0.323	4.55	3.95	1.31	1.29	1.45	0.400	0.564	1.12	8.82	11.0	2.95	3.77
<0.05	<0.1	0.302	<0.1	0.198	0.078	<0.1	<0.1	<0.1	<0.1	<0.1	0.690	15.4	6.33	0.630	0.152
<0.05	0.193	0.420	0.132	2.10	2.48	0.558	0.364	0.329	0.318	0.202	0.537	<0.1	4.36	2.35	2.69
<0.05	0.113	0.408	<0.1	<0.1	<0.1	0.148	0.155	0.224	<0.1	0.205	<0.1	<0.1	3.79	<0.1	0.137
<0.05	0.503	1.15	0.336	2.14	2.24	0.839	0.773	0.747	0.572	0.712	0.788	<0.1	0.933	2.43	2.55
<0.05	<0.1	0.199	<0.1	0.555	0.804	0.174	0.147	0.150	0.939	0.908	0.916	3.10	2.28	0.753	0.748
<0.05	<0.1	1.11	<0.1	0.474	0.340	0.918	0.970	1.27	<0.1	<0.1	0.153	0.325	1.33	0.111	0.371
<0.05	<0.1	0.216	0.109	0.468	0.214	0.218	0.212	0.249	<0.1	0.144	0.456	<0.1	2.38	0.313	0.229
<0.05	0.333	0.773	0.243	0.487	0.602	0.560	0.358	<0.1	0.241	0.461	0.727	0.641	0.348	0.537	0.912
<0.05	0.133	<0.1	<0.1	<0.1	0.177	0.241	<0.1	<0.1	0.237	<0.1	0.186	0.223	0.968	<0.1	0.229
<0.05	<0.1	1.10	0.218	0.139	<0.1	0.307	0.242	0.561	0.361	0.219	0.235	0.108	<0.1	0.145	0.145
<0.05	<0.1	0.175	<0.1	0.119	0.134	0.149	0.124	0.255	<0.1	<0.1	0.211	0.108	0.200	0.134	0.180
0.142	4.17	10.6	3.97	18.0	13.6	7.53	7.36	7.46	3.72	6.03	9.79	37.0	140	20.2	17.7
0.420	9.40	24.0	10.4	49.3	28.5	16.5	15.9	17.3	10.3	15.5	22.1	61.9	198	57.4	42.3
<0.1	<0.2	<0.1	0.146	<0.1	<0.1	0.168	0.175	0.263	<0.2	0.987	1.36	<0.1	<0.1	<0.1	<0.1
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.857	1.19	<0.1	0.307	<0.1	0.574
<0.1	0.710	0.145	0.146	<0.1	<0.1	0.136	0.136	0.208	0.239	0.899	1.33	<0.1	0.334	<0.1	0.738
<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
0.199	2.29	1.89	7.46	45.5	158	2.19	1.63	2.41	2.73	26.7	11.9	49.7	83.4	250	57.3
<0.1	1.88	1.26	1.45	2.81	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<0.1	2.15	1.38	0.951	<0.1	<0.1	1.33	1.73	2.24	1.89	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1