Contents Page No.

G.1 INTRODUCTION

In March 2007 URS was commissioned to undertake an investigation of Plot D on the Whitehaven Site and to carry out a controlled waters risk assessment using relevant data gathered from previous investigations and new data from the 2007 investigation. This appendix presents the methodology and results of the Controlled Water Quantitative Risk Assessment (CWQRA) for Plot D.

The risk assessment is based upon the Mass Balance Model developed in Appendix D of the previous Phase II report (REF: 44319623/R2037, dated 23rd June 2005). The 2005 report recognised that the hydrogeological conditions between the site and the coast were complex, especially in areas underlying the St. Bees Evaporite Formation, which contained enhanced solution features created by acid spills, and as such, recognised that standard risk assessment tools (such as CONSIM) were not suitable for analysis of groundwater flow in this area of the site.

The risk assessment set out in this appendix is considered to be more rigorous and representative of site conditions than the previous risk assessment for the whole of the Whitehaven site as it incorporates additional geological and geochemical data obtained during the Plot D investigation and uses a more sophisticated modelling approach.

The CWQRA is based upon the UK Department of the Environment, Food and Rural Affairs (DEFRA) and Environment Agency (EA) guidance including:

- Environment Agency R&D Publication 20 (1999) Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources (referred to as R&D P-20); and
- Environment Agency R&D Publication CLR11 (2004) Model Procedures for the Management of Land Contamination (referred to as CLR11).

Using CLR 11 methodology, risk assessment is carried out in three stages:

Stage 1 – Preliminary Risk Assessment

Stage 2 - Generic Quantitative Risk Assessment; and

Stage 3 – Detailed Quantitative Risk Assessment.

Stage 1 involves the development of a conceptual understanding of the site and the surrounding environment's geology, hydrogeology, observed contamination (and its distribution), and potential receptors. From this conceptual understanding, potential pollutant linkages (*source-pathway-receptor* relationships) are identified. This stage of the risk assessment is set out in Section 5 of the main body of the report.

Risk assessment at Stages 2 and 3 for Plot D is presented in full in this appendix.

G.2 CONCEPTUAL MODEL SUMMARY

G.2.1 Sources

In Plot D, generally isolated shallow soil, soil leachate, and groundwater contamination was encountered. The maximum value of each Stage 2 exceedance has been considered as individual source terms.

G.2.2 Pathways

The viable pathways applicable to these sources include the leaching and infiltration of soil contamination within the unsaturated shallow strata (made ground and drift) in Plot D, and entry into the underlying shallow groundwater. Contamination then migrates downwards and enters solution enhanced conduits of the generally low permeability St. Bees Evaporites. Once within the evaporites, this water migrates towards the coast via complex subsurface pathways (solution enhanced pipes and fissures) before emerging at the beach at the Byerstead Spring. Tracer testing has provided evidence to suggest that this pathway is rapid, with travel times often less than 10 hours. Such short travel times suggest this migration may be via streams.

Such migration will be characterised by limited attenuation factors (such as dispersion) as compared to more standard groundwater migration within porous media. Therefore, it was considered appropriate to assume that infiltrating contaminated water entering this unit from within Plot D, would remain at this concentration until it reached the site boundary. Beyond this point the only attenuation to occur before the water reached the coast would be through dilution. This dilution was caused by infiltration of clean water from overlying geological units (predominantly the St.Bees Sandstone).

G.2.3 Receptors

The compliance point that is deemed protective of the likely receptor (The Irish Sea) has been determined as the point at which groundwater emerges as a spring at the coastline, the Byerstead Spring, immediately before entering the sea.

G.3 STAGE 2 - GENERIC QUANTITATIVE ASSESSMENT

G.3.1 Methodology

The generic screening was undertaken by making a comparison of measured chemical concentrations in soil, soil leachate, and groundwater against conservative screening criteria appropriate for a designated potential receptor. This initial screening is designed to identify Potential Contaminants of Concern (PCoC), which could pose a potential risk to controlled waters. At the generic screening stage, no consideration is given to pathways or potential attenuation factors such as dilution, dispersion or biodegradation.

For this assessment the receptor is considered to be the Byerstead Spring, which feeds into the Irish Sea, and the screening values that have been used are marine Environmental Quality Standards for soil leachate and shallow groundwater samples. Where published Marine EQS values for certain contaminants were not readily available, reference was made to published Freshwater EQS values. In the absence of Freshwater EQS values, United States Environmental Protection Agency (US EPA) Region 9 Pathway Specific EQS values were used for screening purposes. Where none of these values are available, then reference was made to UK/EU Drinking Water Standards and World Health Authority (WHO) guidelines.

VOC analysis was not carried out on soil leachates as the leaching methodology is unsuitable for VOCs, i.e. it allows VOCs to escape during the leaching process and thus results obtained would be unrealistically low. Thus, for soils samples, concentrations of VOCs have been compared to theoretical soil concentrations that are protective of marine EQS. The theoretical concentrations have been derived using partitioning equations, as outlined in EA R&D-P20 (EA, 1999).

The Stage 2 soils VOC screening values are derived using the following site-specific parameters:

- Total Organic Carbon 0.67%, from site data.
- Soil Type Silty clay
- Total Porosity 38%
- Water filled Porosity 27%
- Air Filled Porosity 11%
- Dry bulk density 1.64g/cm^3

Details of the sources of all Stage 2 screening criteria are given in Tables G1 (soil VOCs) and G2 (soil leachate and groundwater).

Where individual concentrations of contaminants exceeded the generic screening criteria, they have been evaluated further as part of the Stage 3 assessment.

In a limited number of cases soil VOCs and leachate SVOCs, the method detection limit was higher than the screening value for the particular analyte. This occurred in the following analytes:

- Azobenzene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Bis(2-Chloroethyl)Ether
- Dibenz(a,h)anthracene
- Fluoranthene
- Hexachlorobenzene
- Hexachlorobutadiene
- N-Nitroso-Di-N-Propylamine
- 1,1,1,2-Tetrachloroethane-
- 1,2,3-Trichloropropane
- 1,2-Dibromo-3-Chloropropane
- 1,2-Dibromoethane
- 1,2-Dichloropropane
- Bromomethane
- Chloroethane
- Chloroform
- Dichloromethane
- MTBE
- Vinyl Chloride

Standard practice where the MDL is greater than the Screening Value would be to include the analytes as sources at Stage 3, with concentrations at their MDL. It was considered reasonable to discount the majority of the above analytes as the samples taken within Plot D provided no evidence to suggest that these analytes are present within Plot D.

However, this was not the case for Chloroform. This has been measured in soil leachate analysis in apparent isolated hotspots across Plot D, and has been modelled accordingly in the Stage 3 assessments.

G.3.2 Soil Contamination Generic Screening

With the exception of VOC's, generic screening was not performed on soils data. This is because the screening was done using leach test data, which is considered more representative of the potential risks to controlled waters. A summary of the determinands whose concentrations exceeded the Stage 2 generic screening values is given in Table G3 at the end of this report.

G.3.3 Soil Leachate Generic Screening

G.3.3.1 Metals, Anionic Surfactants, Phosphate

A summary of the determinands whose concentrations exceeded the Stage 2 generic screening values is given in Table G4.

G.3.3.2 Total Petroleum Hydrocarbons (TPH)

A summary of the determinands whose concentrations exceeded the Stage 2 generic screening values is given in Table G5.

G.3.3.3 Semi Volatile Organic Compounds (SVOC) and Polycyclic Aromatic Hydrocarbons (PAH)

A summary of the determinands whose concentrations exceeded the Stage 2 generic screening values is given in Table G6.

G.3.4 Groundwater Results Screening

Based on site investigations to date, it is thought that no continuous shallow groundwater is present in Plot D. During the most recent investigation, three boreholes were installed across Plot D, of which one was found to be dry during sampling. Therefore, groundwater data available from Plot D is limited to the analysis of water from borehole WS 416 (sampled in June 2005) and the two new boreholes from which water samples could be obtained.

The results are presented below.

G.3.4.1 Metals, Anionic Surfactants, Phosphates, and Cyanide

A summary of the determinands whose concentrations exceeded the Stage 2 generic screening values is given in Table G7.

G.3.4.2 Total Petroleum Hydrocarbons (TPH)

TPH (total) was not measured in groundwater above the laboratory method detection limits in the samples submitted for analysis.

G.3.4.3 Semi Volatile Organic Compounds (SVOC), Polycyclic Aromatic Hydrocarbons (PAH) and Volatile Organic Compounds (VOCs) in Groundwater

A summary of the determinands whose concentrations exceeded the Stage 2 generic screening values is given in Table G8.

G.3.5 Summary of Identified Exceedances of Generic Screening Criteria (Stage 2)

From the Stage 2 generic screening process the determinands in soils, soil leachate and shallow groundwater that exceeded the Stage 2 screening criteria, are summarised in the table below.

TABLE G3.1 – STAGE 2 EXCEEDANCES

Soil	Soil Leachate	Shallow Groundwater
chloroform	arsenic	copper
trichloroethene	copper	selenium
toluene (2)	lead	nickel
tetrachloroethane	selenium (1)	zinc
	fluoranthene (2)	naphthalene
	phenanthrene	benzo(a)anthracene
	TPH C12-C16 Aromatic	
	TPH C16-C21 Aromatic	

There are a number of analytes that exceed the Stage 2 screening criteria, but have not been taken forward to Stage 3a for several reasons, as follows:

- Copper is found in soil leachate all over the site at concentrations that exceed its EQS. It is thought that this is due to the naturally occurring background concentrations of copper found in the soil. Copper in shallow groundwater at WS416 was measured at a concentration equal to the screening criteria. Copper concentrations in shallow groundwater below the site will be influenced by the copper content of natural soil. Due to this and the detected concentration of copper in groundwater equalling the screening criteria, copper was not considered a potential risk resulting from on site activities.

- Selenium is found in exceedance of its Marine EQS in two shallow ground water samples. One of these samples (WS416) has a selenium concentration of 10μg/l, equal to the EQS. Subsequent dilution of this ground water will reduce the selenium concentration below the EQS, and therefore is not considered to present a risk to the receptor.

- A marginal exceedance of benzo(a)anthracene was detected in groundwater at WS416 (0.11μg/l, screening criteria is 0.09μg/l). Again subsequent dilution would result in a benzo(a)anthracene concentration less than the screening criteria.

- A tetrachloroethene soil concentration of 0.15mg/kg was recorded in WS416 at a depth of 0.45m. From the borehole log for WS416, it is apparent that this sample was taken from granular Made Ground with a shallow groundwater table present, within the Made Ground, approximately 1.2m below ground level. Therefore, it would be highly likely that mobile contamination within the Made Ground would have impacted the shallow groundwater by the present time. However, tetrachloroethene was not detected in water samples from WS416 or the other water samples analysed for Plot D. Therefore, due to the low probability of tetrachloroethene presenting a risk at this location, it was not considered further in this risk assessment.

G.4 STAGE 3A QUANTITATIVE ASSESSMENT- ONSITE DILUTION MODELLING

Stage 3 is divided into stages 3a and 3b. Stage 3a considers individual sources of contamination migrating into the fissures below the site, and the dilution that may occur between migration from the source zone and the point of entry to the evaporites. Stage 3b models the effect of a second dilution within the St Bees evaporites as the solute is transported towards the sea and is diluted by infiltrating groundwater. Stage 3a is described below and Stage 3B is described in Section G5.

G.4.1 Model Selection and Key Model Assumptions

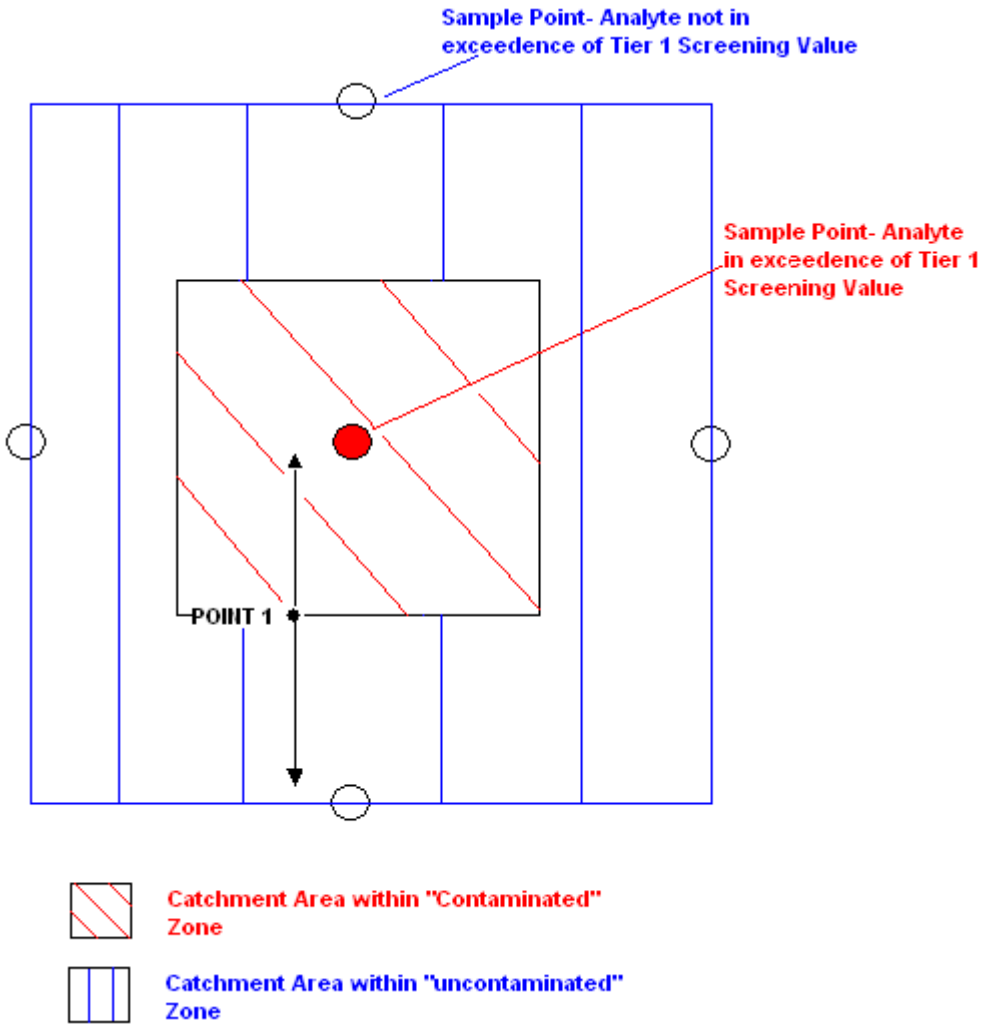
The hydrogeological sequence within Plot D is complex. It has been further compounded by historic site activities, the most prevalent of which has been the deposition of acids into the ground, resulting in voids and channels being created in certain locations, some of which are likely to be in the vicinity of Plot D.

Given the complexity of the geology in Plot D, and the rapid travel times for migration sourced from Plot D, no standard model (e.g. CONSIM, which was used in Plots B and C) was considered to be appropriate. Instead, a mass balance approach was adopted in order to assess potential risks. The principal of the model requires an understanding of the following parameters:

1. Area of inferred “Contaminated” Zone
2. Area of inferred “Uncontaminated “ Zone
3. Concentration identified within the source zone

The process for modelling is described below, using arsenic as an example and the conceptual understanding of the model is presented as Figures G1 and G2.

Arsenic was measured at a concentration of 40μg/L from soil leachate analysis in TP622A, which exceeds the Marine EQS Screening Value of 25μg/l. In surrounding sample locations, measured concentrations of arsenic were less than the Marine EQS.



The likely contaminated and uncontaminated zones surrounding this sample point have been defined as follows:

- The likely extent of contamination is assumed to extend to the half way distance between the central point (which contains contamination in exceedance of the screening criteria) and the peripheral points (which have been deemed "uncontaminated", based on the screening of the current data set). The halfway distance is defined as "Point 1" on the above diagram. The area contained within the halfway points is assumed to represent the source area (diagonally hatched area).

- The *uncontaminated zone* is defined as the remaining area between the half way distance and the sample points where no exceedances have been measured (vertically hatched area).

The combined catchment areas (i.e. contaminated catchment zone + uncontaminated catchment zone) are then referred to as the "total catchment" for that source.

Precipitation falling on this area is assumed to be uniform, before infiltrating downwards through the Made Ground and Drift. Such infiltration is then assumed to be connected to

a solution fissure within the evaporate sequence (thought to be only 3-4m below ground level in Plot D). The solution features and fissures effectively act as drains, collecting all water (contaminated and uncontaminated) within the "total catchment". Given that subsequent transport within the fissure system is rapid with limited dispersion, dilution or degradation, it has conservatively been assumed that at Stage 3a, the analyte concentration entering the St. Bees Evaporite Formation, directly underneath Plot D, could potentially represent the same concentration that emerges at the coastline. Thus, the calculated concentrations entering the fissures would be compared to the Marine EQS Screening Value.

The calculated concentration entering the fissure network has been estimated by diluting the leachable concentrations from identified contaminated areas by the volume of relatively clean water available from the uncontaminated zone of the catchment. For example, for arsenic:

- Percentage of Contaminated Catchment Infiltrating total catchment = 29%;
- Assumed concentration of arsenic in source zone = 40μg/L.
- Therefore, concentration of arsenic as it enters the fracture = 29% x40μg/L = **12μg/L.**

The calculated concentrations at the compliance point (opening to the fissure system) were compared directly against the controlled waters screening criteria, in this instance, the simulated arsenic concentration was below the Screening Value (25μg/L), and therefore no longer considered to represent a potential risk.

G.4.2 Summary of Identified Exceedances (Stage 3a)

The results of the Stage 3a assessment are presented at the end of this report in Table G9 and summarised in Table G4.1.

TABLE G4.1 – STAGE 3 A EXCEEDANCES- SUMMARY

Soil	Soil Leachate	Shallow Groundwater
chloroform	fluoranthene (2)	nickel
trichloroethene	TPH C16-C21 Aromatic	naphthalene
		selenium
		zinc

Analytes which continued to pose a risk at Stage 3a were taken onto Stage 3b modelling.

G.5 STAGE 3B QUANTITATIVE ASSESSMENT- OFFSITE DILUTION MODELLING

G.5.1 Review of Previous Modelling

In the Phase II Investigation conducted in 2005 (REF: 44319623: Phase II Investigations and Environmental Assessments at the Former Albright & Wilson Works, Whitehaven, 23 June 2005), a mass balance approach was adopted to model the contributions of various potential sources to the Byerstead Spring. URS considered that the most appropriate method to characterise the migration of contamination was to adopt a simple mass balance approach. Each contaminant and water mass flux term was characterised and the overall mass/water balance used to establish the likely range of contaminant concentrations in water discharged via the Byerstead fault.

The mass balance approach had been adopted for a number of reasons, including:

- contaminant migration velocities between the site and the fault are known to be extremely fast, as a result of tracer experiments conducted by URS and, therefore, the majority of contaminant migration from the site drainage system will be through "conduits" within the sub-surface, where the primary attenuation mechanisms will be dilution with other waters within the conduits;
- a key question that the Environment Agency and URS has with regards to mass balance is that the sum of the known sources does not add up to the observed water discharging via the Byerstead Fault to the beach. Accounting for these uncertainties will form an integral part of this revised risk assessment; and
- the development of a mass balance approach is relatively simple and easily understood.

G.5.2 Stage 3b Methodology

The current model builds upon the previous modelling. Specifically, it recognises the potential for infiltration of clean water through the St. Bees Sandstone, and subsequent movement into the underlying units, including the St. Bees Evaporites, where the conduits containing the site derived waters are thought to exist.

As such, the model takes the Stage 3a assessment to the next step (through generating a second dilution), by considering rainfall, surface area of infiltration to the St. Bees Sandstone, likely infiltration rates through the Evaporites, and combines this with a mass of contamination (a concentration).

A conceptualisation of the Stage 3a and 3b model is presented in Controlled Waters Appendix G Figures 1 and 2.

At Stage 3a, it is assumed that the concentration generated in the source area (following the dilution from the surrounding clean soil) enters the evaporites at Point 1 (on the

diagram), and remains at this concentration as it passes towards the site boundary at Point 2.

Stage 3b then considers the dilution of this concentration once offsite, as the concentration reduces through dilution from Point 2 to Point 3 (the Byerstead Spring).

This dilution occurs due to a volume of clean water entering the voids/conduits in the evaporite sequence sourced from infiltrating groundwater from the St. Bees Sandstone.

Potential Concentrations at the Byerstead Spring using the above discussion can be estimated as follows:

Concentration at Byerstead Spring = Concentration leaving site A x Df

Where: $Df = \frac{\text{Volume of water leaving site A}}{\text{Volume of water infiltrating St Bees Sandstone}}$

G.5.3 Stage 3b Model Parameters

The generic parameters used for the model are presented below.

TABLE G5.1 – STAGE 3B MODEL PARAMETERS

Source Characterisation			
Source No.	**Source**	**Assessment Method**	**Plausible Distribution**
1	Infiltration through defined source zone on the site	Discharge (Q): Rainfall rate multiplied by an infiltration factor, Q=ARI Area (A): Total source catchment (defined source area and surrounding clean area). A source area of 1000m^2 for the worked example. Mean annual rainfall (R): 1070mm/annum or 0.00293 m/day (Meteorological Office) Infiltration Rate (I), Rainfall percolation into site catchment for individual analyte, maintained at the greenfield runoff rate, I = 7.5 – 22.5%, balancing potential additional losses at the drainage system with the reduced infiltration at buildings and roads. Likely to vary considerably with the impact of the drainage system and the large areas of concrete cover. The final infiltration rate will be dependent upon the state of the land cover once the site has been decommissioned. In the worked example, a volume of 440L was calculated to be flowing in the evaporites away from	Potential Distribution Min I=7.5% Most likely I=15% Max I=22.5% Range above accounts for potential variations in contributing area and infiltration rate. The most likely value of 15% has been used.

Source Characterisation			
Source No.	**Source**	**Assessment Method**	**Plausible Distribution**
		the source area towards the site boundary.	
2	*Infiltration recharge through non-contaminated areas (St. Bees Sandstone)*	Rainfall rate multiplied by an infiltration factor, Q=ARI Area (A): Width of the total onsite catchment (onsite source area and clean area) multiplied by an approximate length of clean source area extending from the western site boundary to the cliff line at the coast (approximately 300m). This results in a thin rectangular strip of clean catchment. This is a conservative assumption. In reality the clean catchment area is likely to be substantially wider. For the worked example the area of St. Bees Catchment was 9486 (300m long x 31.62m^2 wide). Furthermore, the ground between the source area and the site boundary was not included in the model, as it was conservatively assumed to be contaminated, and therefore unable to contribute clean water. Mean annual rainfall (R): 1070mm/annum or 0.00293 m/day (Meteorological Office) Infiltration Rate (I): Rainfall percolation into St. Bees Sandstone: 7.5 – 22.5%, depending upon surface deposits. Lowest over areas containing boulder clay, highest where rockhead (St Bees Sandstone) is at the surface. The volume of groundwater percolating vertically through the St. Bees Sandstone into the underlying St. Bees Shales will be reduced, as a proportion will migrate laterally at the boundary with the less permeable underlying St. Bees Shale, towards the cliffline at the coast, where it will emerge as springs. Once in the shales, the majority of the groundwater will migrate vertically into the underlying sequence that contains the conduits carrying site derived water. There may be some lateral migration, which will generate more springs on the cliff line. In the worked example, a volume of 2086L was calculated to be flowing in the evaporites away from the source area towards the site boundary.	Potential Distribution Min I=7.5% Most likely I=15% Max I=22.5% Range above accounts for potential variations in contributing area and infiltration rate. Given the potential for water loss through coastline springs in the St. Bees Sandstone/St. Bees Shale boundary, the lowest value of 7.5% has been used.

Worked Example

The arsenic example above has been continued through to the 3b level to demonstrate the calculations required to generate the concentrations generated at the Byerstead Spring.

From the 3a model, it was determined that the concentration of arsenic as it enters the fracture/conduit was **11.6μg/L**. Once in this conduit, the contamination will move westwards towards the site boundary at the same concentration.

Beyond the site boundary, a volume of clean water that has infiltrated through the overlying St. Bees Sandstone will dilute this concentration, resulting in a reduced concentration as the water reaches the Byerstead Spring, as follows:

Predicted Concentration at Byerstead Spring = Concentration leaving site (e.g. 11.6μg/l) x Df

Where: Df = $\frac{\text{Volume of water leaving site A (e.g. 440L)}}{\text{Volume of water infiltrating St Bees Sandstone (e.g. 2086L)}}$

Predicted Concentration at Byerstead Spring= 11.6μg/l x 0.2107= **2.45 μg/l**

G.5.4 Summary of Identified Exceedances (Stage 3b)

For simulated contaminant concentrations at the adopted compliance point (in this case, the point at which the groundwater rises as a spring on the beach, the Byerstead Spring) to pose a potentially significant risk to controlled waters, they must be in excess of defined screening criteria. The results of the Stage 3b assessment are presented in Table G10 and are summarised in Table G5.2.

TABLE G5.2 – STAGE 3 B EXCEEDANCES- SUMMARY

Soil	Soil Leachate	Shallow Groundwater
chloroform	fluoranthene	zinc
		naphthalene
		nickel

G.5.5 Limitations and key model assumptions

Key model assumptions include;

- Given that site operations have ceased, it is assumed that the concentration of the individual analytes will not increase, as no fresh contamination inputs to ground will occur in the future. As such, contamination present in soils or groundwater represents residual contamination of a finite mass.
- No attenuation or biodegradation processes have been simulated to occur within the unsaturated zone.
- A component of the historical spillages and leachate infiltration of contaminants through the subsurface will be stored in the aquifers, mines and mine shafts and adits, and slowly released to the coast through seepage along the coast as well as the Byerstead fault, similar to the effect of baseflow on river flow. Similarly

there will be some components of retardation and biological/chemical reactions within the pathway, although this may be limited to the to the component of contaminant mass stored within the subsurface, rather than the rapid movement from the site through the solution features, fractured geology and adits to the Byerstead fault.

- Overall, given the above assumptions and input parameters selected, the Stage 3 assessment is considered to be conservative in nature.

G.6 UNCERTAINTIES

It is acknowledged that there are uncertainties inherent in all risk assessment methodologies, particularly in relation to the assignment of assumed values for difficult to measure site specific variables, such as infiltration rate. However, a reasonable body of research exists such that these variables can be estimated with reasonable accuracy, and in a manner that is known to be conservative. It is therefore likely that risks are, if anything, overestimated, as a result of these assumptions (constant source terms, use of maximum concentrations), and so the results of the controlled waters risk assessment should be viewed in this context.

The assessment can only be undertaken on the data set available from site investigations, thus it is possible that higher concentrations of ground contaminants than observed during the recent site assessment works may exist. This uncertainty has been reduced as far as is reasonably practical with use of a relatively high sampling density and several phases of site investigation. It is also balanced by the inherent conservatism of the modelling process.

G.7 SUMMARY OF RISKS TO CONTROLLED WATERS

The results of the modelling have indicated that potentially significant risks may be present with regard to controlled waters. Two areas of the site: an area extending from TP706D to TP08D; and the area around WS717D and WS416 will require further invesitgation and assessment to determine whether or not remdial action may be required.

The following outline scope of works is recommended to assess the necessity for remdial action.

Area 1- The area in the vicinity of TP708D

It is proposed that up to 4 trial pits are advanced to 5mbgl (or bedrock, if shallower) in the vicinity of TP709D. Soil samples shall be taken at approximately 0.5m intervals for subsequent on site headspace analysis. Up to two samples shall be scheduled for analysis from each location; one shallow sample within the made ground and one deeper sample within the underlying strata, where possible). If a significant presence of contamination is detected, additional samples may be scheduled for analysis. Soil analysis shall include total soil for the presence of VOCs.

Area 2- The area in the vicinity of TP706D

It is proposed that up to 3 trial pits are advanced to 5mbgl (or bedrock, if shallower) and 1 groundwater monitoring well is installed in the vicinity of TP624. Soil samples shall be taken at approximately 0.5m intervals for subsequent on site headspace analysis. Up to two samples shall be scheduled for analysis from each location; one shallow sample within the made ground and one deeper sample within the underlying strata, where possible). If a significant presence of contamination is detected, additional samples may be scheduled for analysis. Soil analysis shall include total soil and soil leachate tests for the presence of SVOCs. Groundwater, where present, shall be scheduled for SVOCs analysis.

Area 3- The area in the vicinity of WS123, WS416 and WS717D

It is proposed that up to 3 trial pits are advanced to 5mbgl (or bedrock, if shallower) and up to 1 groundwater monitoring wells are installed in the vicinity of WS123, WS416 and WS717D. Soil samples shall be taken at approximately 0.5m intervals for subsequent on site headspace analysis. Up to two samples shall be scheduled for analysis from each location; one shallow sample within the made ground and one deeper sample within the underlying strata, where possible). If a significant presence of contamination is detected, additional samples may be scheduled for analysis. Soil analysis shall include total soil and soil leachate tests for the presence of PAHs, zinc and nickel. Groundwater, where present, shall be scheduled for PAHs, zinc and nickel analysis.

Following completion of the investigation, the Stage 3 risk assessment will be updated and the pollutant linkage assessment will be refined accordingly.

G.8 REFERENCES

1) CLR-7 (2002) Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research. Department for the Environment, Food and Rural Affairs (DEFRA) and Environment Agency (EA), Appendix A.

2) CLR-11 (2004) Model Procedures for the Management of Land Contamination" (Environment Agency, 2004).

3) Environment Agency (1999) Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources. Authors Marsland, P.A. and Carey, M.A. Environment Agency R&D Publication 20, 89pp.

TABLES

TABLE G1 – STAGE 2 SCREENING CRITERIA – VOCS IN SOILS

Determinand	Controlled Waters Tier 1 Soil Screening Criteria (mg/kg)	Source
Benzene	3.22E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
1-Butanol	6.85E-01	USEPA Region 9 (pathway specific)
2-Butanone (MEK = methyl ethyl ketone)	2.62E+00	USEPA Region 9 (pathway specific)
Butyl benzyl phthalate (BBP)	2.81E+03	USEPA Region 9 (pathway specific)
n-Butylbenzene	1.86E+00	USEPA Region 9 (pathway specific)
sec-Butylbenzene	4.66E+00	USEPA Region 9 (pathway specific)
tert-Butylbenzene	5.61E+00	USEPA Region 9 (pathway specific)
Carbon Disulphide (Carbon Bisulphide)	5.40E-01	USEPA Region 9 (pathway specific)
Carbon Tetrachloride (tetrachloromethane)	2.78E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 86/280/EEC
1-Chlorobutane	2.83E+00	USEPA Region 9 (pathway specific)
Chloroethane (ethly chloride)	1.01E-03	USEPA Region 9 (pathway specific)
Chloroform (trichloromethane)	5.29E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 88/347/EEC
Chloromethane (methyl chloride)	3.21E-02	USEPA Region 9 (pathway specific)
2-Chloronaphthalene	2.07E+01	USEPA Region 9 (pathway specific)
2-Chlorophenol (o-chlorophenol)	1.38E-01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
1,2-Dichlorobenzene	4.30E+00	WHO DWG
1,3-Dichlorobenzene	2.45E+00	USEPA Region 9 (pathway specific)
1,4-Dichlorobenzene	1.29E+00	WHO DWG
Dichlorodifluoromethane	1.87E+00	USEPA Region 9 (pathway specific)
1,1-Dichloroethane (EDC)	3.18E-01	USEPA Region 9 (pathway specific)
1,2-Dichloroethane(EDC)	5.83E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1992 No 337 (Water Resources, England & Wales)
1,1-Dichloroethene	1.89E-02	WHO DWG
1,2-Dichloroethene (cis + trans) total	2.07E-02	WHO DWG
1,2-Dichloroethene (cis)	2.51E-02	USEPA Region 9 (pathway specific)
1,2-Dichloroethene (trans)	6.59E-02	USEPA Region 9 (pathway specific)
Dichloromethane (see methylene chloride)	6.70E-03	WHO DWG
1,2-Dichloropropane (1,2-DCP)	4.87E-05	UK DWS (2000)
1,3-Dichloropropane	No criterion	UK DWS (2000)
2,2-Dichloropropane	No Criterion	No Criterion

Determinand	Controlled Waters Tier 1 Soil Screening Criteria (mg/kg)	Source
1,3-Dichloropropene	7.88E-03	WHO DWG
2,4-Dinitrophenol	1.20E-02	USEPA Region 9 (pathway specific)
2,4-Dinitrotoluene	3.54E-02	USEPA Region 9 (pathway specific)
2,6-Dinitrotoluene	5.59E-02	USEPA Region 9 (pathway specific)
Hexachlorobenzene	1.11E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 88/347/EEC
Hexachlorobutadiene	3.60E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 88/347/EEC
Hexachlorocyclopentadiene	2.94E+02	USEPA Region 9 (pathway specific)
Hexachloroethane	5.81E-02	USEPA Region 9 (pathway specific)
Iso-Propylbenzene (cumene)	2.37E+00	USEPA Region 9 (pathway specific)
Lindane (HCH-gamma)	1.47E-04	UK Marine / Estuarine EQS
Methanol	3.07E+00	USEPA Region 9 (pathway specific)
Methyl chloride (Chloromethane)	4.05E-03	WHO DWG
Methyl Isobutyl ketone (4-methyl-2-pentanone) MIBK	5.82E-01	USEPA Region 9 (pathway specific)
Methyl tert butyle ether (MTBE)	2.36E-03	USEPA Region 9 (pathway specific)
Methylene chloride (Dichloromethane)	6.70E-03	WHO DWG
Monochlorobenzene	7.32E-01	WHO DWG
Nitrobenzene	1.70E-03	USEPA Region 9 (pathway specific)
m-Nitrotoluene	4.01E-01	USEPA Region 9 (pathway specific)
o-Nitrotoluene	1.47E-04	USEPA Region 9 (pathway specific)
p-Nitrotoluene	1.02E-03	USEPA Region 9 (pathway specific)
Pentachlorobenzene	7.73E+01	USEPA Region 9 (pathway specific)
Pentachlorophenol (PCP)	8.26E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales)
1,2,4,5-Tetrachlorobenzene	4.96E+00	USEPA Region 9 (pathway specific)
1,1,1,2-Tetrachloroethane	4.09E-04	USEPA Region 9 (pathway specific)
1,1,2,2-Tetrachloroethane (PCA)	7.66E-05	USEPA Region 9 (pathway specific)
Tetrachloroethene (Tetrachloroethylene) (PCE)	1.69E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1992 No 337 (Water Resources, England & Wales)
Tetrachloroethene and Trichloroethene (sum of PCE and TCE)	1.28E-02	UK DWS (2000)
Tetrachloromethane (carbon tetrachloride)	2.78E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC

Determinand	Controlled Waters Tier 1 Soil Screening Criteria (mg/kg)	Source
Toluene (Methyl benzene)	4.48E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	2.28E+02	USEPA Region 9 (pathway specific)
1,2,3-Trichlorobenzene	No Criterion	No Criterion
1,2,4-Trichlorobenzene	8.66E-02	USEPA Region 9 (pathway specific)
1,1,1-Trichloroethane (TCA)	1.55E-01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
1,1,2-Trichloroethane	1.91E-01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
Trichloroethene (Trichloroethylene) (TCE)	1.28E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1992 No 337 (Water Resources, England & Wales)
Trichlorofluoromethane (Freon 11)	2.03E+00	USEPA Region 9 (pathway specific)
Trichloromethane (chloroform)	5.29E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Trihalomethanes (sum of, specified note ix)	4.41E-02	UK DWS (2000)
1,2,4-Trimethylbenzene	1.14E-01	USEPA Region 9 (pathway specific)
1,3,5-Trimethylbenzene	1.14E-01	USEPA Region 9 (pathway specific)
Vinyl Chloride	3.20E-04	UK DWS (2000)
o-Xylene	Sum o-xylene and m,p-xylene and use criteria for "Xylenes"	UK Marine / Estuarine EQS
m-Xylene	Sum o-xylene and m,p-xylene and use criteria for "Xylenes"	UK Marine / Estuarine EQS
p-Xylene	Sum o-xylene and m,p-xylene and use criteria for "Xylenes"	UK Marine / Estuarine EQS
Xylenes	9.06E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC

TABLE G2 – STAGE 2 SCREENING CRITERIA – SOIL LEACHATE AND SHALLOW GROUNDWATER

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Acenaphthene	3.65E+02	USEPA Region 9 (pathway specific)
Acenaphthylene	1.00E+01	UK DWS (2000)
Acephate	1.00E-01	UK DWS (2000)
Acetaldehyde	1.75E+00	USEPA Region 9 (pathway specific)
Acetamide	No Criterion	No Criterion
Acetochlor	1.00E-01	UK DWS (2000)
Acetone	5.48E+03	USEPA Region 9 (pathway specific)
Acetonitrile	1.03E+02	USEPA Region 9 (pathway specific)
Acetylchloride	No Criterion	No Criterion
Acrolein	4.16E-02	USEPA Region 9 (pathway specific)
Acrylamide	1.00E-01	UK DWS (2000)
Acrylic Acid	1.82E+04	USEPA Region 9 (pathway specific)
Acrylonitryle	3.89E-02	USEPA Region 9 (pathway specific)
Alachlor	1.00E-01	UK DWS (2000)
Aldicarb	1.00E-01	UK DWS (2000)
Aldrin	1.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 88/34/EEC
Aldrin+Dieldrin	3.00E-02	WHO DWG
Aldrin+Dieldrin+Endrin+Isodrin	3.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Aluminium	2.00E+02	UK DWS (2000)
Ammonia (undissociate NH3 only)	2.10E+01	UK Marine / Estuarine EQS Surface Waters (Fishlife) (Classification) Regulations 1997 No 1331 (Water Resources, England & Wales) 78/659/EEC
Ammonium NH4 (total)	1.00E+03	UK Freshwater EQS Surface Waters (Fishlife) (Classification) Regulations 1997 No 1331 (Water Resources, England & Wales) 78/659/EEC
Aniline	1.18E+01	USEPA Region 9 (pathway specific)
Anthracene	1.83E+03	USEPA Region 9 (pathway specific)
Antimony	5.00E+00	UK DWS (2000)
Arsenic	2.50E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1997 No 2560 (Water Resources, England & Wales)
Atrazine	2.00E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Azinphos-methyl (Guthion)	1.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1997 No 2560 (Water Resources, England & Wales)
Azobenzene	6.11E-01	USEPA Region 9 (pathway specific)
Barium	7.00E+02	WHO DWG
Bentazon	5.00E+02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 389 (Water Resources, England & Wales)
Benzaldehyde	3.65E+03	USEPA Region 9 (pathway specific)
Benzene	3.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
Benz[a]anthracene	9.21E-02	USEPA Region 9 (pathway specific)
Benzo[a]pyrene	1.00E-02	UK DWS (2000)
Benzo[b]fluoranthene	See PAHs	UK DWS (2000)
Benzo[g,h,i]perylene	See PAHs	UK DWS (2000)
Benzo[k]fluoranthene	See PAHs	UK DWS (2000)
Benzoic Acid	1.46E+05	USEPA Region 9 (pathway specific)
Benzyl alcohol	1.09E+04	USEPA Region 9 (pathway specific)
Beryllium	7.30E+01	USEPA Region 9 (pathway specific)
1,1-Biphenyl	2.50E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 389 (Water Resources, England & Wales)
bis(2-chloroethoxy)methane	No Criterion	No Criterion
bis(2-chloroethyl)ether	1.02E-02	USEPA Region 9 (pathway specific)
bis(2-chloroisopropyl)ether	2.74E-01	USEPA Region 9 (pathway specific)
bis(2-ethylhexyl)phthalate (di(2-ethylhexyl)phthalate)(DEHP)	8.00E+00	WHO DWG
bis(chloromethyl)ether	5.15E-05	USEPA Region 9 (pathway specific)
BOD (cyprinid fisheries)	6.00E+03	UK Freshwater EQS Surface Waters (Fishlife) (Classification) Regulations 1997 No 1331 (Water Resources, England & Wales) 78/659/EEC
BOD (salmonid fisheries)	3.00E+03	UK Freshwater EQS Surface Waters (Fishlife) (Classification) Regulations 1997 No 1331 (Water Resources, England & Wales) 78/659/EEC
Boron	7.00E+03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Bromate	1.00E+01	UK DWS (2000)
Bromobenzene	2.03E+01	USEPA Region 9 (pathway specific)
Bromochloromethane	No Criterion	No Criterion
Bromodichloromethane	See note (ix)	UK DWS (2000)

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Bromoform (tribromomethane)	See note (ix)	UK DWS (2000)
Bromomethane (methyl bromide)	8.66E+00	USEPA Region 9 (pathway specific)
4-Bromophenyl-phenylether	No Criterion	No Criterion
Bromoxynil	1.00E+02	UK Marine / Estuarine EQS WRc Report DoE 36271/1 1995
1-Butanol	3.65E+03	USEPA Region 9 (pathway specific)
2-Butanone (MEK = methyl ethyl ketone)	6.97E+03	USEPA Region 9 (pathway specific)
Butyl benzyl phthalate (BBP)	7.30E+03	USEPA Region 9 (pathway specific)
n-Butylbenzene	2.43E+02	USEPA Region 9 (pathway specific)
sec-Butylbenzene	2.43E+02	USEPA Region 9 (pathway specific)
tert-Butylbenzene	2.43E+02	USEPA Region 9 (pathway specific)
Cadmium	2.50E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Calcium	2.50E+05	UK DWS (2000)
Carbazole	3.36E+00	USEPA Region 9 (pathway specific)
Carbofuran	1.00E-01	UK DWS (2000)
Carbon Disulphide (Carbon Bisulphide)	1.04E+03	USEPA Region 9 (pathway specific)
Carbon Tetrachloride (tetrachloromethane)	1.20E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 86/280/EEC
Chlofenvinphos	1.00E-02	UK Marine / Estuarine EQS Environment Agency Research & Development (R&D) Report P12 1996 [NRA R&D Note 216(1993)]
Chlorate	7.00E+02	WHO DWG
Chlordane	1.00E-01	UK DWS (2000)
Chloride	2.50E+05	UK Freshwater EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Chlorine	1.00E+01	UK Marine / Estuarine EQS Surface Waters (Fishlife) (Classification) Regulations 1997 No 1331 (Water Resources, England & Wales) 78/659/EEC
Chlorite	7.00E+02	WHO DWG
4-Chloro-3-methylphenol	4.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
4-Chloroaniline	1.46E+02	USEPA Region 9 (pathway specific)
Chlorobenzenes (sum of mono- to hexa-)	No Criterion	No Criterion

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
1-Chlorobutane	2.43E+03	USEPA Region 9 (pathway specific)
Chloroethane (ethly chloride)	4.64E+00	USEPA Region 9 (pathway specific)
Chloroform (trichloromethane)	1.20E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 88/347/EEC
Chloromethane (methyl chloride)	1.58E+02	USEPA Region 9 (pathway specific)
1-Chloronaphthalene	No Criterion	No Criterion
2-Chloronaphthalene	4.87E+02	USEPA Region 9 (pathway specific)
Chloronitrotoluenes (CNT)	1.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
2-Chlorophenol (o-chlorophenol)	5.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
3-Chlorophenol (m-chlorophenol)	No Criterion	No Criterion
4-Chlorophenol (p-chlorophenol)	No Criterion	No Criterion
4-Chlorophenyl-phenylether	No Criterion	No Criterion
2-Chlorotoluene	1.22E+02	USEPA Region 9 (pathway specific)
4-Chlorotoluene	No Criterion	No Criterion
Chlorotoluron	2.00E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Chlorphenylid	5.00E-02	UK Marine / Estuarine EQS Environment Agency Research & Development (R&D) Report P12 1996
Chromium	1.50E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Chromium III	1.50E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Chromium VI	1.50E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Chrysene	9.21E+00	USEPA Region 9 (pathway specific)
Cobalt	7.30E+02	USEPA Region 9 (pathway specific)
Copper	5.00E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Coumaphos	4.00E-02	UK Marine / Estuarine EQS Environment Agency Research & Development (R&D) Report P12 1996 [NRA R&D) Note 216 (1993)]
o or 2-Cresol (2-methylphenol)	1.82E+03	USEPA Region 9 (pathway specific)
m or 3-Cresol (3-methylphenol)	1.82E+03	USEPA Region 9 (pathway specific)
p or 4-Cresol (4-methylphenol)	1.82E+02	USEPA Region 9 (pathway specific)
Cresoles (sum)	No Criterion	No Criterion
Cyanazine	1.00E-01	UK DWS (2000)
Cyanides complex (pH<5)	No Criterion	No Criterion
Cyanides complex (pH>=5)	No Criterion	No Criterion
Cyanide (free)	5.00E+01	UK DWS (2000)
Cyfluthrin	1.00E-03	UK Marine / Estuarine EQS Department of the Environment (now DETR) Circular 7/89, Environment Agency Research & Development(R&D) Report 12 1996
2,4-D (Dichlorophenoxyacetic acid)	1.00E-01	UK DWS (2000)
2,4-D (ester) (Dichlorophenoxyacetic acid)	1.00E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
2,4-D (non-ester) (Dichlorophenoxyacetic acid)	4.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
2,4-DB	1.00E-01	UK DWS (2000)
4,4`DDD (1,1-dichloro-2,2-bis(4-chlorophenyl)ethane)	1.00E-01	UK DWS (2000)
4,4`DDE (1,1-dichloro-2,2-bis(4-chlorophenyl)ethylene)	1.00E-01	UK DWS (2000)
DDT (1,1,1-trichloro-2,2-bis(4chlorophenyl)ethane)	1.00E-01	UK DWS (2000)
p`p`-DDT (1,1,1-trichloro-2,2-bis(4chlorophenyl)ethane)	1.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 86/280/EEC
DDT(all isomers) (1,1,1-trichloro-2,2-bis(4chlorophenyl)ethane)	2.50E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 86/280/EEC
DDT/DDE/DDD (sum)	1.00E-01	UK DWS (2000)
Decachlorobiphenyls	No Criterion	No Criterion
Demetons (total)	5.00E-01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 389 (Water Resources, England & Wales)
Di(2-ethylhexyl)adipate	8.00E+01	WHO DWG

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Diazinon	1.50E-02	UK Marine / Estuarine EQS Environment Agency Research & Development (R&D) Report P12 1996 [NRA R&D) Note 216 (1993)]
Dibenzo[a,h]anthracene	9.21E-03	USEPA Region 9 (pathway specific)
Dibenzofuran	1.22E+01	USEPA Region 9 (pathway specific)
Dibromoacetonitrile	7.00E+01	WHO DWG
1,2-Dibromo-3-chloropropane	1.00E-01	UK DWS (2000)
Dibromochloromethane	See note (ix)	UK DWS (2000)
1,2-Dibromoethane	1.00E-01	UK DWS (2000)
Dibromomethane	6.08E+01	USEPA Region 9 (pathway specific)
Dibutyl phthalate (DBP)	3.65E+03	USEPA Region 9 (pathway specific)
Dichloroacetate	5.00E+01	WHO DWG
Dichloroacetonitrile	2.00E+01	WHO DWG
1,2-Dichlorobenzene	1.00E+03	WHO DWG
1,3-Dichlorobenzene	1.83E+02	USEPA Region 9 (pathway specific)
1,4-Dichlorobenzene	3.00E+02	WHO DWG
3,3`-Dichlorobenzidine	1.49E-01	USEPA Region 9 (pathway specific)
Dichlorobiphenyls	1.00E-01	UK DWS (2000)
Dichlorodifluoromethane	3.95E+02	USEPA Region 9 (pathway specific)
1,1-Dichloroethane (EDC)	8.11E+02	USEPA Region 9 (pathway specific)
1,2-Dichloroethane(EDC)	1.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1992 No 337 (Water Resources, England & Wales)
1,1-Dichloroethene	3.00E+01	WHO DWG
1,2-Dichloroethene (cis + trans) total	5.00E+01	WHO DWG
1,2-Dichloroethene (cis)	6.08E+01	USEPA Region 9 (pathway specific)
1,2-Dichloroethene (trans)	1.22E+02	USEPA Region 9 (pathway specific)
Dichloromethane (see methylene chloride)	2.00E+01	WHO DWG
2,3-Dichlorophenol	0.00E+00	UK Freshwater EQS
2,4-Dichlorophenol	2.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
2,5-Dichlorophenol	No Criterion	No Criterion
2,6-Dichlorophenol	No Criterion	No Criterion
3,4-Dichlorophenol	No Criterion	No Criterion
3,5-Dichlorophenol	No Criterion	No Criterion
Dichlorprop	1.00E-01	UK DWS (2000)
1,2-Dichloropropane (1,2-DCP)	1.00E-01	UK DWS (2000)
1,3-Dichloropropane	1.00E-01	UK DWS (2000)
2,2-Dichloropropane	No Criterion	No Criterion
1,3-Dichloropropene	2.00E+01	WHO DWG

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Dichlorvos	4.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1997 No 2560 (Water Resources, England & Wales)
Dieldrin	1.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 88/34/EEC
Diethylphthalate (DEP)	2.92E+04	USEPA Region 9 (pathway specific)
Dimethoate	1.00E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 389 (Water Resources, England & Wales)
2,4-Dimethylphenol (DMP)	7.30E+02	USEPA Region 9 (pathway specific)
2,6-Dimethylphenol (DMP)	2.19E+01	USEPA Region 9 (pathway specific)
3,4-Dimethylphenol (DMP)	3.65E+01	USEPA Region 9 (pathway specific)
Dimethylphthalate	3.65E+05	USEPA Region 9 (pathway specific)
4,6-Dinitro-2-methylphenol	3.65E+00	USEPA Region 9 (pathway specific)
2,4-Dinitrophenol	7.30E+01	USEPA Region 9 (pathway specific)
2,4-Dinitrotoluene	7.30E+01	USEPA Region 9 (pathway specific)
2,6-Dinitrotoluene	3.65E+01	USEPA Region 9 (pathway specific)
Di-n-octylphthalate	1.46E+03	USEPA Region 9 (pathway specific)
Diphenyl ether	No Criterion	No Criterion
Diuron	1.00E-01	UK DWS (2000)
DO2 (cyprinid fisheries)	5.00E+03	UK Freshwater EQS Surface Waters (Fishlife) (Classification) Regulations 1997 No 1331 (Water Resources, England & Wales) 78/659/EEC
DO2 (salmonid fisheries)	7.00E+03	UK Freshwater EQS Surface Waters (Fishlife) (Classification) Regulations 1997 No 1331 (Water Resources, England & Wales) 78/659/EEC
DO2 (shellfisheries)	No Criterion	No Criterion
Edetic acid (EDTA)	6.00E+02	WHO DWG
Endosulfan	3.00E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1997 No 2560 (Water Resources, England & Wales)
Endrin	5.00E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 88/347/EEC
Epichlorohydrin	1.00E-01	UK DWS (2000)
Ethyl chloride (chloroethane)	4.64E+00	USEPA Region 9 (pathway specific)
Ethylbenzene	3.00E+02	WHO DWG
Fenchlorphos	1.00E-02	UK Marine / Estuarine EQS Environment Agency Research & Development (R&D) Report P12 1996
Fenitrothion	1.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1997 No 2560 (Water Resources, England & Wales)
Fenoprop	1.00E-01	UK DWS (2000)

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Flucofuron	1.00E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Fluoranthene	2.00E-01	UK DWS (2000)
Fluorene	2.43E+02	USEPA Region 9 (pathway specific)
Fluoride	1.50E+03	UK DWS (2000)
Formaldehyde	5.00E+00	UK Freshwater EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
HCH-alpha	1.00E-01	UK DWS (2000)
HCH-beta	1.00E-01	UK DWS (2000)
HCH-gamma (Lindane)	1.00E-01	UK DWS (2000)
Heptachlor	3.00E-02	UK DWS (2000)
Heptachlor and heptachlor epoxide	3.00E-02	UK DWS (2000)
Heptachlorobiphenyls	1.00E-01	UK DWS (2000)
Heptachlor epoxide	1.00E-01	UK DWS (2000)
Hexachlorobenzene	3.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 88/347/EEC
Hexachlorobiphenyls	1.00E-01	UK DWS (2000)
Hexachlorobutadiene	1.00E-01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 88/347/EEC
Hexachlorocyclohexane	2.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 84/491/EEC
Hexachlorocyclopentadiene	2.19E+02	USEPA Region 9 (pathway specific)
Hexachloroethane	4.80E+00	USEPA Region 9 (pathway specific)
Hydrogen sulphide	1.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Hydroquinone	No Criterion	No Criterion
Indeno[1,2,3-cd]pyrene	See PAHs	UK DWS (2000)
Ioxynil	1.00E+01	UK Marine / Estuarine EQS Environment Agency Research & Development (R&D) Report P12 1996
Iron	1.00E+03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Isodrin	5.00E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales)
Isophorone	7.08E+01	USEPA Region 9 (pathway specific)
Iso-Propylbenzene (cumene)	6.58E+02	USEPA Region 9 (pathway specific)
p-Isopropyltoluene	No Criterion	No Criterion
Isoproturon	2-20	UK Freshwater EQS Environment Agency Research & Development (R&D) Technical Summary 173(xi) 1999
Kjeldahl nitrogen/Total Organic Nitrogen (N)	1.00E+03	UK DWS (2000)
Lead	2.50E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Lead (tetraethyl)	3.65E-03	USEPA Region 9 (pathway specific)
Lindane (HCH-gamma)	2.00E-02	UK Marine / Estuarine EQS
Linuron	2.00E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
Lithium	7.30E+02	USEPA Region 9 (pathway specific)
Magnesium	5.00E+04	UK DWS (2000)
Malachite Green	5.00E-01	UK Freshwater EQS Environment Agency Research & Development (R&D) Report P12 1996
Malathion	2.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1997 No 2560 (Water Resources, England & Wales)
Manganese	5.00E+01	UK DWS (2000)
Manganese and compounds	No Criterion	No Criterion
MCPA (2-methyl-4-chlorophenoxy acetic acid)	2.00E+00	UK Marine / Estuarine EQS DETR (1997) National EQSs for Dangerous Substances in Water; Draft Regulations and Compliance Cost Assessment
Mecoprop	2.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
Mercury (elemental)	1.00E+00	UK DWS (2000)
Mercury (inorganic compounds)	3.00E-01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Mercury (methyl)	3.65E+00	USEPA Region 9 (pathway specific)

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Mercury and compounds	3.00E-01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Methanol	1.82E+04	USEPA Region 9 (pathway specific)
Methoxychlor	1.00E-01	UK DWS (2000)
Methyl chloride (Chloromethane)	2.00E+01	WHO DWG
Methyl ethyl ketone (MEK) (2-Butanone)	6.97E+03	USEPA Region 9 (pathway specific)
Methyl Isobutyl ketone (4-methyl-2-pentanone) MIBK	1.99E+03	USEPA Region 9 (pathway specific)
Methyl tert butyle ether (MTBE)	1.10E+01	USEPA Region 9 (pathway specific)
Methylcyclohexane	5.22E+03	USEPA Region 9 (pathway specific)
Methylene chloride (Dichloromethane)	2.00E+01	WHO DWG
2-Methylnaphthalene	No Criterion	No Criterion
1-Methylnaphthalene	No Criterion	No Criterion
4-Methylphenol	1.82E+02	USEPA Region 9 (pathway specific)
Metolachlor	1.00E-01	UK DWS (2000)
Mevinphos	2.00E-02	UK Freshwater EQS UK EQS
Molinate	1.00E-01	UK DWS (2000)
Molybdenum	7.00E+01	WHO DWG
Monochloroacetate	2.00E+01	WHO DWG
Monochlorobenzene	3.00E+02	WHO DWG
Monochlorobiphenyls	1.00E-01	UK DWS (2000)
Monochloramine	3.00E+03	WHO DWG
Naphthalene	5.00E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Nickel	3.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Nitrate (NO3)	5.00E+04	UK DWS (2000)
Nitrite - consumers taps (NO2)	0.01 - 0.03	UK Freshwater EQS Surface Waters (Fishlife) (Classification) Regulations 1997 No 1331 (Water Resources, England & Wales) 78/659/EEC
Nitrite - ex works (NO2)	0.01 - 0.03	UK Freshwater EQS Surface Waters (Fishlife) (Classification) Regulations 1997 No 1331 (Water Resources, England & Wales) 78/659/EEC
Nitrilotriacetic acid	2.00E+02	WHO DWG
2-Nitroaniline	1.09E+02	USEPA Region 9 (pathway specific)
3-Nitroaniline	3.20E+00	USEPA Region 9 (pathway specific)
4-Nitroaniline	3.20E+00	USEPA Region 9 (pathway specific)

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Nitrobenzene	3.40E+00	USEPA Region 9 (pathway specific)
2-Nitrophenol	No Criterion	No Criterion
4-Nitrophenol	No Criterion	No Criterion
n-Nitroso-di-n-propylamine	9.60E-03	USEPA Region 9 (pathway specific)
n-Nitrosodiphenylamine	1.37E+01	USEPA Region 9 (pathway specific)
m-Nitrotoluene	1.22E+02	USEPA Region 9 (pathway specific)
o-Nitrotoluene	4.87E-02	USEPA Region 9 (pathway specific)
p-Nitrotoluene	6.59E-01	USEPA Region 9 (pathway specific)
Nonachlorobiphenyls	1.00E-01	UK DWS (2000)
Octachlorobiphenyls	1.00E-01	UK DWS (2000)
Omethoate	1.00E-02	UK Freshwater EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
Organotin compounds	No Criterion	No Criterion
Oxidizability (permanganate value) (O2)	5.00E+03	UK DWS (2000)
PAHs (sum of 4, specified note (vii))	1.00E-01	UK DWS (2000)
PAHs (sum of 10)	No Criterion	No Criterion
PCB 28	1.00E-01	UK DWS (2000)
PCB 52	1.00E-01	UK DWS (2000)
PCB 77	1.00E-01	UK DWS (2000)
PCB 81	1.00E-01	UK DWS (2000)
PCB 101	1.00E-01	UK DWS (2000)
PCB 105	1.00E-01	UK DWS (2000)
PCB 114	1.00E-01	UK DWS (2000)
PCB 118	1.00E-01	UK DWS (2000)
PCB 123	1.00E-01	UK DWS (2000)
PCB 126	1.00E-01	UK DWS (2000)
PCB 138	1.00E-01	UK DWS (2000)
PCB 153	1.00E-01	UK DWS (2000)
PCB 156	1.00E-01	UK DWS (2000)
PCB 157	1.00E-01	UK DWS (2000)
PCB 167	1.00E-01	UK DWS (2000)
PCB 169	1.00E-01	UK DWS (2000)
PCB 180	1.00E-01	UK DWS (2000)
PCB 189	1.00E-01	UK DWS (2000)
PCB (total)	5.00E-01	UK DWS (2000)
PCB Aroclor-1016 (42% Cl)	1.00E-01	UK DWS (2000)
PCB Aroclor-1221	1.00E-01	UK DWS (2000)
PCB Aroclor-1232	1.00E-01	UK DWS (2000)
PCB Aroclor-1242	1.00E-01	UK DWS (2000)
PCB Aroclor-1248	1.00E-01	UK DWS (2000)
PCB Aroclor-1254	1.00E-01	UK DWS (2000)
PCB Aroclor-1260	1.00E-01	UK DWS (2000)

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
PCBs (sum of 7 - see comment)	5.00E-01	UK DWS (2000)
PCSDs	5.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Pendimethalin	1.00E-01	UK DWS (2000)
Pentachlorobenzene	2.92E+01	USEPA Region 9 (pathway specific)
Pentachlorophenol (PCP)	2.00E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales)
Perchlorethylene (refer to PCE)	1.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Permethrin	1.00E-02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Pesticides: Total substances (sum)	5.00E-01	UK DWS (2000)
pH	6 - 8.5	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Phenanthrene	1.00E+01	UK DWS (2000)
Phenol	3.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Phenols (phenol index)	2.20E+03	UK DWS (2000)
Phosphorus	2.20E+03	UK DWS (2000)
Phosphorus (white)	7.30E-01	USEPA Region 9 (pathway specific)
Potassium	1.20E+04	UK DWS (2000)
Propazine	1.00E-01	UK DWS (2000)
Propetamphos	1.00E-02	UK Marine / Estuarine EQS Environment Agency Research & Development (R&D) Report P12 1996
n-Propylbenzene	2.43E+02	USEPA Region 9 (pathway specific)
Pyrene	1.83E+02	USEPA Region 9 (pathway specific)
Pyridine	3.65E+01	USEPA Region 9 (pathway specific)
Resorcinol	No Criterion	No Criterion
Selenium	1.00E+01	UK DWS (2000)
Silver	5.00E-01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Simazine	2.00E+00	UK Marine / Estuarine EQS UK EQS
Sodium	0.00E+00	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Styrene	5.00E+01	UK Marine / Estuarine EQS UK EQS
Sulcofuron (Sulcofuron-sodium)	2.50E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Sulphate	2.50E+05	UK DWS (2000)
Surfactants (as lauryl sulphate)	2.00E+02	UK DWS (2000)
2,3,7,8-TCDD (Tetrachlorodibenzodioxin)	4.48E-07	USEPA Region 9 (pathway specific)
Tecnazene	1.00E+00	UK Marine / Estuarine EQS Environment Agency Research & Development (R&D) Report P12 1996
Terbuthylazine	1.00E-01	UK DWS (2000)
Terbutryn	1.00E-01	UK DWS (2000)
1,2,3,4-Tetrachlorobenzene	No Criterion	No Criterion
1,2,3,5-Tetrachlorobenzene	No Criterion	No Criterion
1,2,4,5-Tetrachlorobenzene	1.09E+01	USEPA Region 9 (pathway specific)
Tetrachlorobiphenyls	1.00E-01	UK DWS (2000)
1,1,1,2-Tetrachloroethane	4.32E-01	USEPA Region 9 (pathway specific)
1,1,2,2-Tetrachloroethane (PCA)	5.53E-02	USEPA Region 9 (pathway specific)
Tetrachloroethene (Tetrachloroethylene) (PCE)	1.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1992 No 337 (Water Resources, England & Wales)
Tetrachloroethene and Trichloroethene (sum of PCE and TCE)	1.00E+01	UK DWS (2000)
Tetrachloromethane (carbon tetrachloride)	1.20E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
2,3,4,5-Tetrachlorophenol	No Criterion	No Criterion
2,3,4,6-Tetrachlorophenol	1.09E+03	USEPA Region 9 (pathway specific)
2,3,5,6-Tetrachlorophenol	No Criterion	No Criterion
Thalium acetate	No Criterion	No Criterion
Thalium carbonate	No Criterion	No Criterion
Thalium chloride	No Criterion	No Criterion
Thalium nitrate	No Criterion	No Criterion
Thalium sulphate	No Criterion	No Criterion
Thalium and inorganic compounds	No Criterion	No Criterion

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Tin	1.00E+01	UK Marine / Estuarine EQS Environment Agency Research & Development (R&D) Report P12 1996
Toluene (Methyl benzene)	4.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
TPH (>EC5-7) aromatic	1.00E+01	UK DWS (2000)
TPH (>EC6-7) aromatic	1.00E+01	UK DWS (2000)
TPH (>EC7-8) aromatic	1.00E+01	UK DWS (2000)
TPH (>EC8-10) aromatic	1.00E+01	UK DWS (2000)
TPH (>EC10-12) aromatic	1.00E+01	UK DWS (2000)
TPH (>EC12-16) aromatic	1.00E+01	UK DWS (2000)
TPH (>EC16-21) aromatic	1.00E+01	UK DWS (2000)
TPH (>EC21-35) aromatic	1.00E+01	UK DWS (2000)
TPH (>EC5-6) aliphatic	1.00E+01	UK DWS (2000)
TPH (>EC6-8) aliphatic	1.00E+01	UK DWS (2000)
TPH (>EC7-8) aliphatic	1.00E+01	UK DWS (2000)
TPH (>EC8-10) aliphatic	1.00E+01	UK DWS (2000)
TPH (>EC10-12) aliphatic	1.00E+01	UK DWS (2000)
TPH (>EC12-16) aliphatic	1.00E+01	UK DWS (2000)
TPH (>EC16-21) aliphatic	1.00E+01	UK DWS (2000)
TPH (EC21-35) aliphatic	1.00E+01	UK DWS (2000)
TPH (Total)	1.00E+01	UK DWS (2000)
Triazaphos	5.00E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
Tributly tin	2.00E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Tributyl tin oxide (TBTO)	2.00E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	5.92E+04	USEPA Region 9 (pathway specific)
Trichloroacetate	2.00E+02	WHO DWG
Trichloroacetaldehyde (Chloral Hydrate)	1.00E+01	WHO DWG
1,2,3-Trichlorobenzene	No Criterion	No Criterion
1,2,4-Trichlorobenzene	7.16E+00	USEPA Region 9 (pathway specific)
1,3,5-Trichlorobenzene	0.00E+00	UK Freshwater EQS
Trichlorobenzenes (total)	4.00E-01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Trichlorobiphenyls	1.00E-01	UK DWS (2000)

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
1,1,1-Trichloroethane (TCA)	1.00E+02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
1,1,2-Trichloroethane	3.00E+02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1998 No 389 (Water Resources, England & Wales)
Trichloroethene (Trichloroethylene) (TCE)	1.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1992 No 337 (Water Resources, England & Wales)
Trichlorofluoromethane (Freon 11)	1.29E+03	USEPA Region 9 (pathway specific)
Trichloromethane (chloroform)	1.20E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
2,3,4-Trichlorophenol	No Criterion	No Criterion
2,3,5-Trichlorophenol	No Criterion	No Criterion
2,3,6-Trichlorophenol	No Criterion	No Criterion
2,4,5-Trichlorophenol	9.00E+00	WHO DWG
2,4,6-Trichlorophenol	2.00E+02	WHO DWG
3,4,5-Trichlorophenol	No Criterion	No Criterion
1,2,3-Trichloropropane	5.60E-03	USEPA Region 9 (pathway specific)
1,2,3-Trichloropropene	2.18E+00	USEPA Region 9 (pathway specific)
Trifluralin	1.00E-01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1997 No 2560 (Water Resources, England & Wales)
Trihalomethanes (sum of, specified note ix)	1.00E+02	UK DWS (2000)
1,2,4-Trimethylbenzene	1.23E+01	USEPA Region 9 (pathway specific)
1,3,5-Trimethylbenzene	1.23E+01	USEPA Region 9 (pathway specific)
Triphenyl tin	8.00E-03	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1997 No 2560 (Water Resources, England & Wales)
Uranium	1.50E+01	WHO DWG
Vanadium	1.00E+02	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Vinyl Chloride	5.00E-01	UK DWS (2000)
o-Xylene	Sum o-xylene and m,p-xylene and use criteria for "Xylenes"	UK Marine / Estuarine EQS
m-Xylene	Sum o-xylene and m,p-xylene and use criteria for "Xylenes"	UK Marine / Estuarine EQS
p-Xylene	Sum o-xylene and m,p-xylene and use criteria for "Xylenes"	UK Marine / Estuarine EQS

Determinand	Controlled Waters Generic Screening Criteria UK Marine/Estuarine EQS (µg/l)	Source
Xylenes	3.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC
Zinc	4.00E+01	UK Marine / Estuarine EQS Surface Waters (Dangerous Substances)(Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC

Table G3 a – Stage 2 Assessment – VOCs in Soils

Contaminant	Source Area Concentration (mg/kg)	Controlled Waters Screening Criteria (mg/kg)	Koc	H'	Simulated Porewater Concentrations (Soil Source Concentrations) (mg/l)
Chloroform	0.079	0.00529	43.7	0.154	0.169
Trichloroethene	0.025	0.0128	93.3	0.418	0.031
Toluene	0.058	0.048	140	0.275	0.052
Toluene	0.056	0.048	140	0.275	0.050

Table G3 b – Stage 2 Assessment – VOCs in Soils

Target Compound	Generic Controlled Waters Screening Criteria (µg/L)	Statistical Analysis					Number of Samples Exceeding Generic Screen
		Minimum (µg/L)	Maximum (µg/L)	Mean (µg/L)	US95 (µg/L)	Number Analysed	
Chloroform	12	<mdl	106	-	*	28	1
Trichloroethene	10	<mdl	22.3	-	*	28	1
Toluene (Methyl benzene)	40	<mdl	52	51	57.31	28	2
* Not possible to calculate US95 because only one measurement above method detection limit.							

Table G4 – Stage 2 Assessment – Leachable Metals & Surfactant

Target Compound	Tier 1 Controlled Waters (µg/L)	Statistical Analysis						Number of Samples Exceeding Tier 1
		Minimum	Maximum	Geomean	Mean	US95	Number Analysed	
ARSENIC	25	<mdl	55	3.39	7.53	13.76	20	1
COPPER	5	<mdl	73	9.41	13	18.72	20	18
LEAD	25	<mdl	38	2.91	7.83	19.99	20	1
SELENIUM	10	<mdl	26	4.52	6.26	9.09	20	2

Table G5 – Stage 2 Assessment – Leachable TPH

Target Compound	Tier 1 Controlled Waters (µg/L)	Statistical Analysis						Number of Samples Exceeding Tier 1
		Minimum	Maximum	Geomean	Mean	US95	Number Analysed	
TPH C12-C16 AROMATIC	10	<mdl	37	-	-	*	31	1
TPH C16-C21 AROMATIC	10	<mdl	100	-	-	*	31	1
TPH C5-C35 ALIPHATIC	10	<mdl	140	-	-	*	31	1
* Not possible to calculate US95 because only one measurement above method detection limit.								

Table G6 – Stage 2 Assessment – Leachable SVOC and PAH

Target Compound	Tier 1 Controlled Waters (µg/L)	Statistical Analysis						Number of Samples Exceeding Tier 1
		Minimum	Maximum	Geomean	Mean	US95	Number Analysed	
FLUORANTHENE	0.2	<mdl	5	3.61	3.5	12.97	31	2
PHENANTHRENE	10	<mdl	28	-	-	*	31	1

Table G7 – Stage 2 Assessment –Shallow Groundwater Metals & Inorganic Compounds

Target Compound	Tier 1 Controlled Waters (µg/L)	Statistical Analysis						Number of Samples Exceeding Tier 1
		Minimum	Maximum	Geomean	Mean	US95	Number Analysed	
COPPER	5	2	5	3.16	3.5	12.97	2	1
MAGNESIUM	50000	63840	63840	-	-	*	1	1
NICKEL	30	11	206	47.60	108.5	724.12	2	1
SELENIUM	10	10	20	14.14	15	46.57	2	1
ZINC	40	<mdl	375	54.77	191.5	1350.2	2	1
* Not possible to calculate US95 because only one measurement above method detection limit.								

Table G8 – Stage 2 Assessment –Shallow Groundwater VOCs and SVOCs

Target Compound	Tier 1 Controlled Waters (ug/L)	Statistical Analysis						Number of Samples Exceeding Tier 1
		Minimum	Maximum	Geomean	Mean	US95	Number Analysed	
NAPHTHALENE	5	<mdl	72	-	-	-	2	1
* Not possible to calculate US95 because only one measurement above method detection limit.								

Table G9 – Stage 3a Assessment

Analyte	Measured Concentration (µg/L)	Marine EQS Screening Value (µg/L)	Type of contamination	Location	Estimated catchment area of contamination (m^2)	Estimated catchment area of clean water (m^2)	Total catchment (m^2)	Percentage of Contaminated Catchment Infiltrating Total Catchment	Resultant simulated concentration as analyte enters Evaporites (µg/L)	Marine EQS Screening Value Exceeded
Fluoranthene	5.0	0.20	Soil leachate hotspot	TP706D	1250	3550	4800	26.04%	1.30	**YES**
Phenanthrene	28.0	10	Soil leachate hotspot	TP706D	1250	3550	4800	26.04%	7.29	NO
TPH Aromatic 12-16	37.0	10	Soil leachate hotspot	TP706D	1250	3550	4800	26.04%	9.64	NO
TPH Aromatic 16-21	100.0	10	Soil leachate hotspot	TP706D	1250	3550	4800	26.04%	26.92	**YES**
Toluene*	51.7	40	Soil hotspot	WS402	300	1050	1350	22%	11.7	NO
Fluoranthene	2.0	0.20	Soil leachate hotspot	TP713D	580	2500	3080	19%	0.38	**YES**
Arsenic	55.0	25	Soil leachate hotspot	WS715D	750	1900	2650	28.30%	15.57	NO
Selenium	17.0	10	Soil leachate hotspot	TP718D	1550	3050	4600	33.70%	5.73	NO
Selenium	20.0	10	Groundwater hotspot	WS715D	1550	0	1550	100.00%	20.00	**YES**
Lead	38.0	25	Soil leachate hotspot	TP709	350	1100	1450	24%	9	NO
Chloroform*	168.9	12	Soil hotspot	TP708D	750	1900	2650	28.30%	47.8	**YES**
Trichloroethene*	30.6	10	Soil hotspot	TP708D	1550	3050	4600	33.70%	10.30	**YES**
Naphthalene	72	5	Groundwater hotspot	WS717D	1500	0	1500	100%	72	**YES**
Toluene*	50	40	Soil hotspot	WS416	450	1300	1750	26%	12.84	NO
Nickel	206	30	Groundwater hotspot	WS115	1500	0	1500	100%	206	**YES**
Zinc	375	40	Groundwater hotspot	WS416	1500	0	1500	100%	375	**YES**

***** Porewater concentrations calculated from concentration measured in soil

Table G10 – Stage 3b Assessment

Analyte	Resultant simulated concentration as analyte enters Evaporites (µg/L)	Rainfall (m/day)	Infiltration into Source Zone and Clean Zone around Source (%)	Effective Rainfall (m/day)	Area of Source and Clean Zone Around Source (m2)	Discharge Contribution from onsite source zone and dilution zone (L/day)	Infiltration into St. Bees Sandstone (%)	Effective Rainfall (m/day)	Length of St. Bees Dilution Zone (m)	Width of St. Bees Dilution Zone (m)	Discharge Contribution from St. Bees Dilution Zone (L/day)	Dilution Factor	Concentration after Dilution with Clean St. Bees Water (µg/L)	Marine EQS Screening Value (µg/L)
Fluoranthene	1.30	0.0029	15%	0.0004	4800	2111	7.5%	0.0002	300	69	4570	**0.46**	**0.6**	**0.20**
TPH Aromatic 16-21	26.9	0.0029	15%	0.0004	2600	1143	7.5%	0.0002	300	51	3363	0.34	9.2	10
Fluoranthene	0.38	0.0029	15%	0.0004	3080	1354	7.5%	0.0002	300	55	3661	0.37	0.1	0.20
Selenium	20	0.0029	15%	0.0004	1550	682	7.5%	0.0002	300	39	2597	0.26	5.3	10
Chloroform*	47.8	0.0029	15%	0.0004	2650	1165	7.5%	0.0002	300	51	3395	**0.34**	**16.4**	**12**
Trichloroethene*	10.3	0.0029	15%	0.0004	4600	2023	7.5%	0.0002	300	68	4474	0.45	4.7	10
Naphthalene	72	0.0029	15%	0.0004	1500	660	7.5%	0.0002	300	39	2555	**0.26**	**19**	**5**
Nickel	206	0.0029	15%	0.0004	1500	660	7.5%	0.0002	300	39	2555	**0.26**	**53**	**30**
Zinc	375	0.0029	15%	0.0004	1500	660	7.5%	0.0002	300	39	2555	**0.26**	**97**	**40**

***** Porewater concentrations calculated from concentration measured in soil