KOPPERS UK LIMITED

Scunthorpe

Design of a Site Protection and Monitoring Programme

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General

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Rev 0	April 2005	Issued for Client Comment
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EXECUTIVE SUMMARY

This document represents the design of a Site Protection and Monitoring Programme (SPMP) requiring reference data to be collected for Koppers UK Limited, Scunthorpe, which has been submitted to the Environment Agency in pursuance of Condition 4.1.7 of the Permit N^{o} BV1356IQ (the "Permit") authorising the operation of the Tar Distillery and associated activities (the "installation").

This design document is required by Condition 4.1.7 to be submitted to the Agency within 2 months of the date of issue of the Permit. The permit was issued on the 2nd March 2005.

An intrusive investigation using boreholes is required to be undertaken to characterise substances identified as being potentially present in, on or under the ground in the Application Site Report Annex (including Phase 1a Site Report) submitted with the Permit Application. This document also contains the scope of those investigations to collect Reference Data and should be read in conjunction with the Application Site Report Annex (including Phase 1a Site Report) for the installation.

The Environmental Monitoring Programme for the installation is presented in Section 4 and Appendices B to E. The results of routine monitoring will be collated into a Monitoring Report and sent to the Agency by the 31st of January each year. The Monitoring Report will also contain any recommendations for changes to the Site Protection and Monitoring Programme which will be incorporated into the SPMP subject to the agreement, in writing, of the Agency. The format of the Monitoring Report is given in Appendix E3.

The testing, inspection and maintenance programme for pollution prevention infrastructure at the site (the Infrastructure Monitoring Programme) has been designed as detailed in Section 4.4 and Appendix E2.

CONTENTS

1. INTRODUCTION

HFL Risk Services Limited was commissioned by Koppers UK Limited to produce a Site Protection and Monitoring Programme (SPMP) requiring reference data to be collected for their production facility at Scunthorpe as part of their IPPC Authorisation. This SPMP has been prepared following the guidelines given in Ref. [1] and will be agreed with the Environment Agency (EA) prior to the commencement of the investigation. The SPMP will then be updated accordingly.

It should be noted that the field investigations proposed have been restricted to the level of detail required to achieve the stated objectives of the work and to the scope recommended in Ref. [2]. Other contaminants which were not identified in Ref. [2] may also be present and may not be identified in this investigation. As the recommendations contained in this report are based partially on information provided by others, HFL Risk Services have made the assumption that all relevant information has been provided from whom it has been requested.

1.1. Site Location

The installation is located at:

Scunthorpe Works

Dawes Lane

Scunthorpe

North Lincolnshire

DN15 6UR

The installation lies within the north east of England (centred on (NGR) SE 9020 1170), 1km east of Scunthorpe town centre (centred on (NGR) SE 8900 1100) as illustrated in Figure 1 of Appendix A1. The site is situated within an industrial area that borders a residential zone to the west. Land east of the site comprises old refuse tips, slag heaps and an old iron works. To the south there is a large railway depot and further industrial units. North of the site comprises car / lorry dismantlers, a waste regeneration site and small industrial units, leaving the west and south west consisting of numerous commercial and residential units.

1.2. Details of Installation

An IPPC Permit is issued for an ‘installation’ rather than a process. The installation is defined as all buildings or land on the site upon which operations are carried out that are essential to the process. This may or may not include the whole of the site owned by the company.

It is HFL Risk Services’ understanding that the installation covered by the IPPC Permit is the 11 hectare area occupied by the process activities and the Imperial Tankers wash facility. The installation boundary to the north east of the site includes the effluent pipeline to Corus Biological Effluent Treatment Plant (BETP). The following areas are excluded from the installation:

- The remainder of Imperial Tankers to the west of the site;
- The dormant licensed landfill and earlier closed process landfill on the north west boundary;
- The Corus BETP; and
- The lagoon.

The operations conducted under the permit are described briefly below. However, a detailed description of the operations can be viewed in Section 2.1.1.2 of Ref. [3] and Section 3 of Ref. [2].

The main process is to decant, neutralise, dehydrate and distill coke oven crude tar or petroleum tar in order to produce pitch and various fractionated oils. Fractionated oils include light oil, carbolic oil, naphthalene oil, absorbing oil, anthracene oil and base oil and carbon black feedstock oil. The pitch yield is normally 48 – 52% of the tar throughput but varies with the softening point of pitch being produced and the source of the crude tar. Batches of liquid pitch can be further processed by transfer to either the pencil pitch plant, where it is solidified and removed by screw conveyor or the EVT tar mixers for blending with fractionated oils or petroleum oil to produce materials for use in the carbon, pipe coating and paint industries.

Crude tar that is initially centrifuged produces special pitch which could be further processed in the special pitch blending plant where site produced oils and / or xylene are added to obtain the desired specification.

2. OBJECTIVES

The objectives of this report are:

- To design investigations to collect reference data for the installation by:
  - Obtaining sufficient information with respect to the site to allow the refinement of the conceptual model of the site and its surroundings.
  - Designing a robust and adequate intrusive investigation, which would allow the collection of more reference data for the installation.
- To design a monitoring programme for the installation to:
  - Monitor the effectiveness of pollution prevention infrastructure and provide early warning of any release of polluting substances to ground or groundwater.
  - To collect data on the condition of the ground / groundwater at the installation to assist in the permit surrender process.
  - To monitor the movement of pollutants in the ground and / or groundwater beneath the site of the installation.
- To review and if necessary amend the inspection, testing and maintenance programme for pollution prevention infrastructure at the installation to ensure their continued integrity.

3. INTRUSIVE INVESTIGATIONS

The objectives of the intrusive investigations are:

- To collect data to reduce the uncertainties in the conceptual model presented as Section 6 of the Application Site Report Annex (including Phase 1a Site Report) submitted with the permit application.

- To collect sufficient data on the chemicals of potential concern (CoPCs) identified in the Application Site Report Annex (including Phase 1a Site Report) in order to set reference data for the site.

3.1. Investigation and Sampling Strategy

3.1.1. General

The investigation will be undertaken within 4 months of the SPMP being approved by the EA and will be conducted by a competent contractor using a third party accredited laboratory (MCERTS accredited for soil and preferably UKAS accredited for groundwater) for testing the samples collected.

This investigation has been based on the preliminary zoning of the site detailed in Section 5 of Ref. [2]. Twelve zones representing process and non-process areas were defined (see Figure 3 in Appendix A1). Samples will be taken from those zones where there is a reasonable possibility of pollution. It has been determined that an investigation will be required in all zones. Soil and groundwater samples will be taken and analysed in each of these areas. Chemicals and areas of potential concern were identified in Ref. [2] by assessing the potential to pollute of all current and historical substances handled on the site.

The initial CSM in Section 6 and Appendix E of Ref. [2] identified three potential sources of pollution. The pollutants were identified as being either from failure of containment, spillage or historical contaminants from previous land uses. It is anticipated that the potentially polluting substances have leached from the ground or leaked onto unprotected ground and have migrated vertically and laterally through the soil. The potentially polluting substances may have been transported into the groundwater and the River Trent via the migration of potentially polluting substances through the soil to the groundwater and then recharging into the surface water courses. The initial CSM is reproduced in Figure 1 of Appendix A3.

Following the Application Site Report Annex (including Phase 1a report) site records indicated the site has 14 gas monitoring points (some of which are located outside the installation boundary) as illustrated in Figure 4 of Appendix A1. Soil and groundwater have previously been sampled and analysed through the use of trial pits however, no permanent monitoring boreholes were installed for groundwater sampling. Therefore eight new boreholes will be installed to provide good coverage of the whole site. The locations of the proposed boreholes are illustrated in Figure 4 of Appendix A1 and will be agreed with the EA prior to conducting the intrusive investigation.

The Works Manager has overall responsibility for ensuring that maintenance required is carried out. He is responsible for ensuring that preventative maintenance is prioritised and carried out to ensure the possibility of impact on the environment is minimised. The Works Manager is also responsible for ensuring that there are regular inspections of major 'non-productive' items such as tanks, pipework and bunds. The Works Manager and the Works Chemist have responsibility for managing documentation and records for monitoring, scheduling and maintaining the results of audits to ensure compliance, for results of reviews and for complaints and incidents. Further details of responsibilities for management systems are provided in Sections 2.3.1 and 2.3.2 of Ref. [3].

Prior to the commencement of the investigation a site specific health and safety plan for the proposed works will be developed by Koppers or an appropriate contractor. An environmental risk assessment will be developed to address the potential risks posed by the proposed intrusive investigations to create new migratory pathways.

3.1.2. Constraints on Investigations

It is proposed to install eight new boreholes on site, which are illustrated in Figure 4 of Appendix A1. However, the location of the boreholes may have to be altered in order to avoid compromising bunds and other pollution control measures; to maintain the integrity of surface finishes and to prevent the generation of preferential pathways. A competent contractor will be used to install the boreholes in order to minimise the possibility of creating a preferential pathway by installing the borehole incorrectly. Borehole locations may also have to be adjusted if there is insufficient space surrounding the proposed borehole for the drilling equipment or if slag balls are encountered. Prior to the collection of data a drawing of underground services and pipelines (See Figure 5 of Appendix A1) will be inspected and a cable automated tool (CAT) will be used prior to the dig to detect the presence of underground services. Sample locations will also be agreed with the EA and site management prior to the investigation commencing.

It should be noted that a number of limitations are attached to the design of the intrusive investigation. These limitations include:

- Despite the Scunthorpe site being 11 hectares in size the main process areas / zones are considerably compact in their layout. Thus, there are relatively few accessible areas in the zoned areas in which intrusive investigations could be conducted.

- Due to the number of potentially flammable products utilised and produced on-site there are limited areas in which intrusive investigations can be conducted, without disrupting or breaching health and safety regulations.

3.1.3. Soil Investigation and Sampling Techniques and Protocols

It is proposed that the eight new borehole locations will require soil sampling and all of which will be installed as permanent monitoring wells for groundwater sampling and monitoring. Due to the conditions encountered at the site, it is considered that shallow sampling will be best achieved using a hand held cable percussion drilling rig (the use of percussion by repeatedly lifting and dropping a heavy string of drilling tools or weight into a borehole). The drilling method will be agreed with a competent contractor following the approval of the SPMP by the EA and the SPMP will be updated if necessary. Any surface contaminants such as tarmac residue will be removed from the surface prior to taking the samples at the required depths. If undisturbed samples cannot be taken, disturbed samples from the borehole using this method are generally sufficiently representative to allow recording of the strata. However, care will need to be taken to avoid misinterpretation due to ground being pushed down within the borehole. A precise description of the soil horizons or layers encountered during the sampling will be recorded. Soil samples will be taken from approximately every 0.5 metres (or as considered appropriate during the intrusive investigation) of the core from the borehole.

In addition to soil logging and other observations made during the site investigations, portable monitoring instruments will be used to detect ionisable vapours to provide a guide to the potential volatile contamination of the soil. Samples will be placed in sealed plastic bags and left for a short time. The headspace above the soil in each container will then be tested using a Photo Ionisation Detector (PID) machine.

Soil samples will be analysed for the Chemicals of Potential Concern (CoPC) (or representative indicator substances) identified in Section 6 of Ref. [2] in Table C1 of Appendix C1.

These samples will be transferred directly into the appropriate laboratory supplied labelled container (glass for organic compounds and plastic for inorganic compounds), logged and transferred to the laboratory for analysis.

On-site personnel undertaking or supervising the sampling will have the discretion to take additional samples as a result of on-site observations. Photographs will be taken during the investigation and will be included in Appendix A2 on the completion of the investigation.

The sampling and analytical quality assurance and quality control plan in Appendix D1 details the controls and checks that will be undertaken during the sampling, sample handling and transportation of samples.

The standard operating procedures for the collection and testing of soil samples are contained in Appendix B1.

3.1.4. Groundwater Investigation and Sampling Techniques and Protocols

Groundwater samples (and associated dissolved, emulsified or free product pollutants) will be taken from the proposed boreholes identified in Section 7 of Ref. [2] (See Figure 4 of Appendix A1). Prior to sampling the water within the wells the water level will be measured using a dip meter from the top of the well to provide the basis of a hydrogeological conceptual model.

The water samples will be collected using a battery-operated electric submersible pump unless the water level in the borehole is low in which case a peristaltic pump will be used. Where possible, time will be allowed for groundwater to stabilise in these wells before sampling is performed.

The sample pumps will be run for approximately 3 minutes to purge the well before collecting the sample. This will remove standing water within the well in order to obtain a representative sample from the aquifer. The internal borehole volume and samples will not be taken until the measurements of the purged groundwater characteristics (pH and EC) have stabilised.

At least one litre of groundwater will be collected per sample from the boreholes (larger samples may be required depending on the requirements of the laboratory). Two or three sets of samples will be taken over a short period of time (separated by a few weeks) and these water samples will be transferred directly into the appropriate laboratory supplied labelled container, logged and transferred to the laboratory for analysis.

Water samples will be analysed for the CoPC (or representative indicator substances) identified in Section 6 of Ref. [2] in Table C1 of Appendix C1.

On-site personnel undertaking or supervising the sampling will have the discretion to take additional samples as a result of on-site observations.

The sampling and analytical quality assurance and quality control plan in Appendix D1 details the controls and checks that will be undertaken during the sampling, sample handling and transportation of samples.

The standard operating procedures for the collection and testing of groundwater samples are contained in Appendix B2.

3.1.5. Soil-Gas and Vapour Investigation and Sampling Techniques and Protocols

Sampling of soil-gas and vapours is not required to collect reference data for the site.

3.1.6. Surface Water Investigation and Sampling Techniques and Protocols

There are no areas of surface water within the installation boundary. Therefore sampling of surface water is not required to collect reference data for the site.

3.1.7. Infrastructure Investigation and Sampling Techniques and Protocols

All infrastructure investigations are visual inspections, no integrity testing is conducted on site.

3.1.7.1. Sub-surface Structures

There is currently no formal procedure for inspecting and maintaining sub-surface structures. Maintenance is carried out on request when it is noticed that attention is required. This is being addressed as part of the site improvement programme (Ref. [3]).

3.1.7.2. Bunds

There is a formal procedure for the inspection of bunds every six months. Damage to any bund would also be observed by personnel carrying out their normal duties; such damage would be reported and a request made for repairs to be carried out as soon as practicable.

Bund contents are not tested before being pumped out to the effluent system. The six monthly bund inspection would identify whether the bund contains layers of product or oils, this would also be included in “on the job” training. Testing of the bund contents is not considered necessary since most of the materials are insoluble in water and would form an upper or lower (mainly) layer in the bund and in many cases would also solidify. In the cases where the materials are water soluble (e.g. caustic and hydrochloric acid) the release of these materials would not be harmful since the pH of the effluent is adjusted prior to being pumped to Corus for treatment.

In the majority of cases bunds and bund sumps are emptied by opening a drain valve allowing any bund contents into the drainage system via an interceptor and subsequently into the effluent tank before being pumped to Corus for treatment. There is currently no control of these valves which could be inadvertently left open however, the drains in all the bunds are to be replaced with air or steam ejectors. In the event of the contents of the bund being contaminated they would be pumped out by works sludge gulper.

3.1.7.3. Surface Finishes

There is currently no formal procedure for checking the integrity of surface finishes, though all of the surface finishes in use are suitable for their duty when in good condition. Maintenance is carried out on request when it is noticed that attention is required. This is being addressed as part of the site improvement programme (Ref. [3]).

3.1.7.4. Storage Tanks and Pipelines

There is currently no formal procedure for inspecting and maintaining storage tanks and pipelines. Maintenance is carried out on request when it is noticed that attention is required. This is being addressed as part of the site improvement programme (Ref. [3]).

3.2. Sample Locations

Sample locations were chosen with reference to the sources, pathways and receptors identified within the conceptual model for the site detailed in Section 5 of Ref. [2]. All of the sample locations will also identify historical contaminants beneath the ground at the site.

It is anticipated that the new sample locations will be located using Global Positioning System (GPS). This will be confirmed and details regarding accuracy will be included following discussions with contractors when the SPMP has been approved by the EA.

Proposed sample locations for the site are shown on Figure 4 of Appendix A1.

Discussion of the selection, justification and design for each sample location with respect to individual zones for the site are given in the following sections.

Samples will be referenced using the following classification system taken from Ref. [4]:

Samples will be classified according to the zone number and borehole number, whether the borehole is a permanent monitoring point, sampling phase (e.g. “100 series” for the exploratory phase, “200 series”, “300 series” and so on thereafter) and sample number, i.e. 1BH1M101 where:

1 = Zone number

BH = Borehole

1 = Borehole number

M = Permanent monitoring installation

100 = Phase of investigation

1 = Sample number

3.2.1. Zones 1A / 1B (Crude Tar Raw Materials)

Sample locations for Zone 1 are shown on Figure 4 of Appendix A1.

There are no sample locations within Zone 1B due to the limitations discussed in Section 3.1.2 but boreholes in the surrounding area (adjacent to Zone 3B) will identify materials which may be transported by groundwater or leaching.

Sample Location BH2

BH2 is located outside of Zone 1A but should identify any contaminants likely to be found in this zone. Therefore this borehole will be used as a sample location in the intrusive investigation.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 5m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

3.2.2. Zones 2A / 2B (Coal Tar Processing)

The sample locations for Zone 2 are shown on Figure 4 of Appendix A1.

There are no sample locations within Zone 2A due to the limitations discussed in Section 3.1.2 but boreholes in the surrounding area (adjacent to Zone 9B) will identify materials which may be transported by groundwater or leaching.

Sample Location BH3

BH3 is located outside of Zone 2B but should identify any contaminants likely to be found in Zone 2B and any contaminants from the tanker wash down area. Therefore this borehole will be used as a sample location in the intrusive investigation.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 8m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

3.2.3. Zones 3A / 3B (Pitch Storage)

The sample locations for Zone 3 are shown on Figure 4 of Appendix A1.

There are no sample locations within Zone 3A due to the limitations discussed in Section 3.1.2 but boreholes in the surrounding area (adjacent to Zone 9B) will identify materials which may be transported by groundwater or leaching.

Sample Location BH5

BH5 is located adjacent to Zone 3B and should identify any contaminants likely to be found in this zone.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 8m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

3.2.4. Zones 4A – 4F (Intermediate Oils)

Sample locations for Zone 4 are shown on Figure 4 of Appendix A1.

There are no sample locations within Zones 4C and 4E due to the limitations discussed in Section 3.1.2 but boreholes for Zones 4A, 4B, 4D and 4F will identify whether these materials are likely to be found in the ground or groundwater beneath the site. All the boreholes for sampling these areas are located to the north / north east of the areas of interest as it is anticipated that the potential pollutants will be transported in the same direction as the groundwater flow.

Sample Location BH2

BH2 is located outside of Zone 4A but should identify any contaminants likely to be found in this zone. Therefore this borehole will be used as a sample location in the intrusive investigation.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 5m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

Sample Location BH4

BH4 is located outside of Zone 4D and 4F but should identify any contaminants likely to be found in this zone. Therefore this borehole will be used as a sample location in the intrusive investigation.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern identified in the initial

CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 8m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

Sample Location BH8

BH8 is located on the edge of Zone 4B and should identify any contaminants likely to be found in this zone. Therefore this borehole will be used as a sample location in the intrusive investigation.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 8m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

3.2.5. Zone 5 (Petroleum Processing)

Sample locations for Zone 5 are shown on Figure 4 of Appendix A1.

Sample Location BH5

BH5 is located adjacent to Zone 5 and should identify any contaminants likely to be found in this zone.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 8m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

3.2.6. Zones 6A / 6B (Special Pitch Processing)

No sample locations within this zone due to the limitations discussed in Section 3.1.2 but boreholes in the surrounding area (Zone 8 and Zone 12) may identify materials which may be transported by groundwater or leaching.

3.2.7. Zone 7 (Pencil Pitch Processing)

BH6 is located adjacent to Zone 7 and should identify any contaminants likely to be found in this zone.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 8m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

3.2.8. Zone 8 (Effluent Collection Area)

BH7 is located adjacent to Zone 8 and should identify any contaminants likely to be found in this zone.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 8m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

3.2.9. Zones 9A / 9B (Utilities)

Sample locations for Zone 9 are shown on Figure 4 of Appendix A1.

Sample Location BH1

BH1 is located outside of Zone 9A but should identify any contaminants likely to be found in this zone. Therefore this borehole will be used as a sample location in the intrusive investigation.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern due to historical waste disposal / spillage identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 5m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

Sample Location BH4

BH4 is located outside of Zone 9B but should identify any contaminants likely to be found in this zone. Therefore this borehole will be used as a sample location in the intrusive investigation.

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 8m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

3.2.10. Zone 10 (Offices and Ancillaries)

BH1 is located on the edge of Zone 10 but should identify any historical contaminants likely to be found in this zone.

Sample Location BH1

The investigation in this area will be undertaken in accordance with the sampling protocols in Appendices B1-B2.

The sample locations form part of a random sampling pattern for the site to identify background pollutant levels in the zone and look at areas of concern due to historical waste disposal / spillage identified in the initial CSM. It is anticipated that any pollutants may potentially be transported towards sensitive receptors via groundwater or via leaching from the soil into groundwater.

Groundwater samples will be taken from the maximum depth of the borehole, allowing time for the groundwater to stabilise before sampling is performed. Soil samples will be taken every half metre, or where significant changes in the strata occur, to a depth of up to 5m below ground level (or until ironstone is reached). At least 500g of soil for each sample and 1 litre of groundwater from each borehole will be sampled for laboratory analysis. Larger samples may be required depending on the requirements of the laboratory.

3.2.11. Zones 11A / 11B (Redundant Plant)

No sample locations within this zone due to the limitations discussed in Section 3.1.2 but boreholes in the surrounding area (adjacent to Zone 7) may identify materials which may be transported by groundwater or leaching.

3.2.12. Zone 12 (Remaining Areas)

All of the boreholes except BH1 are actually located in Zone 12 due to the compact nature of the process areas. The boreholes have all been cited to identify pollutants from specific areas of concern however, any pollutants beneath the site within Zone 12 will also be identified.

3.3. Analytical Strategy

3.3.1. Justification of Analytical Suites

A full site inventory of substances and materials used, stored or produced on site was developed in Section 6 of Ref. [2]. The substances identified were combined to form a list of important chemicals associated with the site. These chemicals were assessed against potential human health and environmentally harmful effects, mobility and persistence within the ground and groundwater environments (See Section 5.3 of Ref. [2]). The resultant CoPC and their indicator substances which will be used for the analytical suite for each zone are detailed in Table C1 of Appendix C1.

3.3.2. Justification of Analytical / Field Technique and Detection Limits

The laboratory analytical technique for each analysis is referenced in Tables C2a to C2b of Appendix C2. Some of the proposed methods are not MCERTS / UKAS accredited. However, an analytical method summary, method validation test data and on-going quality control method statements will be provided once a laboratory has been selected following the approval of the SPMP by the EA.

Detection Limits for each analytical and field technique are shown in Tables C2a to C2b. Wherever possible the lowest detection limit available from laboratories has been chosen, except where this entails significant extra cost. Given the anticipated high levels of pollution beneath the site from historical activities for all the indicator substances, it is considered that the detection limits in Tables C2a and C2b are likely to be adequate.

The following sections provide a justification for choosing a particular technique for a particular substance in a particular phase. The detection limits of a substance using that technique are justified with respect to expected background concentrations and likely pollutant distribution and concentration.

It is anticipated that the analytical methods detailed below will be used. However, the laboratory analytical techniques for each analysis will be confirmed following the approval of the SPMP by the EA. The analysis will be carried out by a third party accredited (MCERTS accredited for soil analysis and preferably UKAS accredited for water analysis) laboratory and discussions will be held with the laboratory regarding the proposed analytical methods and detection limits. It is intended that the analyte detection limits will be lower than the environmental standard that the results are being compared with. Discussions will also be held with the EA to agree detection limits to ensure any environmentally significant pollutant distributions on the site are identified. The SPMP will then be updated accordingly.

3.3.2.1. Total Petroleum Hydrocarbons (TPH)

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for Total Petroleum Hydrocarbons. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

This analytical technique covers the normal range of hydrocarbons in Total Petroleum Hydrocarbons.

No interference from other substances identified as CoPC is anticipated.

3.3.2.2. Poly Aromatic Hydrocarbons (PAH)

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for PAHs. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

This analytical technique covers the normal range of hydrocarbons in oils.

No interference from other substances identified as CoPC is anticipated, although several CoPC will give a positive result.

3.3.2.3. Benzene, Toluene, Ethylbenzene and Xylenes (BTEX)

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for BTEX. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated, although several CoPC will give a positive result.

3.3.2.4. pH

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for pH.

There are a range of alkaline and acidic substances on site which will interact to neutralise each other. There may also be substances already in the soil which could react to adjust the pH. It is unlikely that there will be a large acid and alkaline leak at the same time therefore any gross changes in pH will still be detected.

3.3.2.5. Na^{+} Ions

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for sodium. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated, although several CoPC will give a positive result.

3.3.2.6. PO_4^{2-} Ions

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for phosphate. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated, although several CoPC will give a positive result.

3.3.2.7. NO_4^{2-} Ions

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for nitrate. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated.

3.3.2.8. SCN^-

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for thiocyanate. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated.

3.3.2.9. Br^- Ions

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for bromide. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated, although several CoPC will give a positive result.

3.3.2.10. NH_4^+ Ions

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for ammonium. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

There will be no interference from other substances identified as CoPC, although several CoPC will give a positive result. However ammonium will gradually degrade to nitrates.

3.3.2.11. Cu^{+} Ions

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for copper. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

There will be no interference from other substances identified as CoPC.

3.3.2.12. Ni^{+} Ions

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for nickel. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

There will be no interference from other substances identified as CoPC.

3.3.2.13. Pb^{2+} Ions

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for lead. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

There will be no interference from other substances identified as CoPC.

3.3.2.14. Cl^{-} Ions

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for chloride. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

Hydrochloric acid, ammonium chloride and bromine chloride will all contribute to the total chloride detected. However, additional tests for ammonia and bromine will differentiate between them.

3.3.2.15. Phenols

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for phenols. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference form other substances identified as CoPC is anticipated, although several CoPC will give a positive result.

3.3.2.16. CN^- Ions

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for cyanide. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference form other substances identified as CoPC is anticipated, although several CoPC will give a positive result.

3.3.2.17. Total Sulphur

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for sulphur. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated.

3.3.2.18. SVOC (Tentatively Identified Compounds)

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for ethanolamine. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated.

3.3.2.19. Fe

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for iron. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated.

3.3.2.20. Ca^{2+}

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for calcium. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated.

3.3.2.21. Sulphide

The analytical techniques identified in Tables C2a and C2b of Appendix C2 have been selected as they are recognised / accredited methods for analysing for sulphide. The proposed detection limits are the lowest achieved by the laboratory using the analytical methods detailed in Appendix C2.

No interference from other substances identified as CoPC is anticipated.

3.3.3. Laboratory Accreditation / Quality Assurance and Quality Control

3.3.3.1. Laboratory Accreditation

A 3rd party accredited laboratory (MCERTS accredited for soil and preferably UKAS accredited for groundwater) will be used to analyse the soil and groundwater samples taken. The analytical techniques used are detailed in Tables C2a and C2b of Appendix C2. The laboratory's quality assurance procedures for any individual techniques undertaken which are not UKAS accredited will be detailed in Appendix C2 once the laboratory has been selected following the approval of the SPMP by the EA.

3.3.3.2. Quality Control

Appendix D1 contains the sampling and analytical quality assurance and quality control plan.

4. MONITORING PROGRAMME

4.1. Objectives of the Monitoring Programme

4.1.1. Objectives of Environmental Monitoring Programme

The objectives of the monitoring programme are:

- To monitor the effectiveness of infrastructure and management procedures and provide a warning of loss of containment.
- To assist at Permit surrender by:
    - determining the movement of pollutants onto or off the site of an installation.
    - determining the movement of pollutants within a site.
    - providing data on long term trends.

4.1.2. Objectives of Infrastructure Monitoring

Infrastructure monitoring will enable Koppers to continually monitor the condition of the ground and groundwater beneath the site and will help to identify any loss of containment from a storage tank.

4.2. Environmental Monitoring Infrastructure

4.2.1. Location

Figure 4 of Appendix A1 shows the proposed location of monitoring points at the installation.

4.2.2. Groundwater Monitoring

It is proposed that all 8 of the new boreholes are used for ongoing groundwater monitoring. Each monitoring point will have a lockable cover and will be designed to prevent the ingress of surface water.

4.2.3. Soil Vapour Monitoring

No on-going soil vapour monitoring will occur at the installation during the life of the permit. It is considered that any loss of containment would be identified during regular patrols of the plant throughout the shift by operators or through groundwater monitoring. See Section 3.1.5.

4.2.4. Soil Monitoring

No on-going soil monitoring will occur at the installation during the life of the permit. Soil samples are simply being taken as part of the intrusive investigation to provide a baseline for the site. See Section 3.1.3.

4.2.5. Procedure for the Inspection and Maintenance of Environmental Monitoring Infrastructure

There is currently no formal procedure in place for the inspection and maintenance of the environmental monitoring infrastructure. The groundwater monitoring boreholes will require periodic maintenance and it is anticipated that the inspection frequency will be high in the initial stages of the monitoring programme, until the characteristics of the deterioration in the performance of the infrastructure can be ascertained.

A general outline of the procedure to be followed is provided in Appendix E1. The final version of the procedure will be written following this outline once the SPMP has been approved by the EA.

4.3. Environmental Monitoring Programme

4.3.1. Monitoring Frequency

The proposed environmental monitoring programme, including QA/QC checks is contained in Appendix E1 and is summarised below.

Groundwater Monitoring Programme	
Frequency and Timing	Sample annually over a period of approximately 1 month.
Emergency Monitoring Plan	Increase frequency of groundwater monitoring to identify source and extent of pollution and need for remediation.
Sampling Protocol	See Appendix B2.
Sample Collection	Appropriate boreholes for ongoing monitoring will be identified. The potential for cross contamination within samples will be minimised and a detailed sample record will be maintained.
Sample Preservation	Groundwater samples will be collected in appropriate containers and preserved / handled in accordance with guidance from the laboratory.
Handling and Storage	Samples will be appropriately labelled and logged. Samples will be transported to the laboratory as soon as possible to minimise any potential for chemical or biological changes to take place.
Analytical Suites	The samples will be analysed for the CoPC identified in the Application Site Report Annex (including Phase 1a Site Report).

Groundwater Monitoring Programme	
Analytical Protocols	Details of sample preparation and analysis will be provided once a laboratory has been selected following the approval of the SPMP by the EA. The SPMP will then be updated accordingly.
Quality Control / Quality Assurance	Samples will be taken by a trained member of staff.

4.3.2. Sampling and Analysis Protocols

The protocols for analysis will remain the same as those to be used for the investigations to collect reference data detailed in Section 3.3 and reproduced in Appendix C, except only groundwater samples will be taken.

Sampling protocols are contained within Appendix B.

4.3.3. Personnel Issues

Personnel responsible for sampling, maintenance and inspection will be trained in environmental monitoring to an appropriate level to ensure compliance with the quality assurance and quality control plan. Roles and responsibilities for monitoring and ensuring adequate competence of staff are shown in Appendix E1.8.

4.4. Infrastructure Monitoring Programme

The existing inspection, testing and maintenance of pollution prevention infrastructure programme will meet the objectives identified within Section 4.1.2 above once the improvements identified in Ref. [3] have been completed and thus there will be some changes to the EMS programme for the installation summarised within the Permit Application. The procedures for the inspection, testing and maintenance of the pollution prevention infrastructure will continue during the life of the permit and will be reviewed and modified as necessary (i.e. if there are changes to infrastructure, working practices, or if there are any changes to guidance / statutory procedures which the procedure is based upon).

An assessment, record and reporting procedure will be maintained as part of the SPMP (See Section 4.5) for the purposes of demonstrating continued compliance with Permit conditions and for the purposes of applying to surrender a permit.

4.4.1. Personnel Issues

Personnel responsible for the inspection, testing and maintenance of pollution prevention infrastructure are to be trained to an appropriate level to ensure compliance with the Infrastructure Monitoring Programme. Roles and responsibilities for undertaking the programme (including reporting) and ensuring adequate competence of staff are shown in Appendix E2.

4.5. Assessment and Reporting Procedures

4.5.1. Assessment Procedure

This section provides an outline of the assessment procedure to be used to monitor groundwater. A formal procedure following this outline will be issued following the approval of the SPMP by the EA.

The groundwater monitoring data will be assessed and evaluated to determine if activities have or are likely to have adversely affected groundwater. This assessment will be undertaken on an annual basis following the collation of the monitoring data and any significant variations will be explained. Monitoring data will be assessed in a time series to determine the range of natural variation in pollutants concentrations. Trigger values, which will initiate more intensive monitoring and investigation if they are exceeded, will be set following the initial investigation.

Appropriate remedial / control measures will be promptly implemented when it is determined that an adverse effect on the groundwater or surface water has occurred or is likely to occur. Investigations, evaluations and / or remedial measures will be implemented on a prioritised basis to resolve additional community or governmental concerns.

The frequency of monitoring will be reviewed and reduced wherever possible (after agreement with the EA) as trends in pollutant concentrations are characterised and improvements to the pollution prevention infrastructure (as required) are shown to have been successful. The assessment frequency will be increased if it is considered necessary or if the sampling frequency is increased.

4.5.2. Reporting Procedure

Summaries of the monitoring data will be sent to the EA on the 31st of January each year along with the results of the data assessment, and any recommendations for amendments to the Monitoring Programme. Any documents sent by post to the EA must have a fax sent requesting the EA to respond if the mailed documents are not received.

The formats for standard and emergency reporting procedures are shown in Appendix E3.

4.5.3. Recording and Data Management

Responsibilities

- The Works Manager has overall responsibility for all the required documentation.
- The Works Chemist has the responsibility for ensuring that records are completed and filed and for reviewing, approving and issuing all document formats.

Distribution and Filing of Records

Monitoring records and results of reviews will be maintained on the site network database. Originals or copies of originals will be completed and distributed as required or identified on the individual documents. All records will be, following completion of action or activity, filed in the correct file or location when not in use.

Retention of Records

Documented records and written instructions will be retained for a minimum of 5 years. At the end of the retention period no documents or discs will be destroyed without the knowledge and approval of the Works Manager.

Computer generated records will be backed up on a daily basis and copies retained in an appropriate location.

All records will be identified, indexed, filed and accessible when required. Storage will ensure that no loss, damage or deterioration occurs in all prescribed locations.

5. REFERENCES

[1] Environment Agency, (August 2003).Technical Guidance Note IPPC H7 Guidance on the Protection of Land Under the PPC Regime: Application Site Report and Site Protection and Monitoring Programme.

[2] Koppers UK Limited, Scunthorpe Tar Distillery, Application Site Report Annex (including Phase 1a Site Report) for PPC Application, March 2004

[3] Koppers UK Limited (March 2004) IPPC Application Part 2 – Form B

[4] Environment Agency (2000) Technical Aspects of Site Investigation. Volume I (of II) Overview. Technical Report P5-065/TR

6. GLOSSARY

BETP – Biological effluent treatment plant

BTEX – Benzene, toluene, ethylbenzene and xylenes

CAT – Cable Automated Tool

CoPC – Chemicals of Potential Concern

CSM – Conceptual Site Model

DCM – Dichloromethane

EA – Environment Agency

EC – Electrical Conductivity

EPA – United States Environmental Protection Agency

FIA – Flow Injection Analysis

GCFID – Gas Chromatograph Flame Ionisation Detector

GPS – General Positioning System

ICPMS – Inductively Coupled Plasma Mass Spectrometry

ICPOES – Inductively Coupled Plasma Optical Emission Spectroscopy

IHM – In House Method

MAFF – Ministry Agriculture Food and Fisheries

MCERTS – Environment Agency's Monitoring Certification Scheme

NGR – National Grid Reference

PAH – Polycyclic Aromatic Hydrocarbons

PET – Polyethylene Terephthalate

PID – Photo Ionisation Detector

QA – Quality Assurance

QC – Quality Control

SPMP – Site Protection and Monitoring Programme

TIC – Tentatively Identified Compounds

TPH – Total Petroleum Hydrocarbons

UKAS – United Kingdom Accreditation Service

APPENDIX A: Figures and Plans

Appendix A1: Plans

Figure 1: Site Location Map

Figure 2: Site Plan

Figure 3: Site Zoning

Figure 4: Location of Current and Proposed Boreholes

4a: Current Gas Monitoring Locations

4b: Proposed Borehole Locations

Figure 5: Underground Services and Pipelines

(a) Emergency Water Supply

(b) Underground Gas Main

(c) Underground 11 KV Cable

(d) Underground Dry Ring Main

(e) Underground Process Pipelines

(f) Underground Drainage Pipelines

Appendix A2: Photographs

Photographs will be appended following the intrusive investigation.

Appendix A3: Diagrammatic Representations of Conceptual Site Model

Only a tabular output of the conceptual model was provided in the ASR. A diagrammatic representation of the conceptual model was not provided as it was considered that in relation to the number of environmentally harmful materials stored, transported, produced and handled on site and the number of potential emission points and relevant activities, the tabular representation of the conceptual model was deemed the most effective way of representing the information required. Therefore the tabular conceptual model has been provided in this SPMP rather than a diagrammatic representation.

Key to Uncertainties

Letter	Uncertainty in the CSM
A	Made Ground: Thickness, particle size distribution, heterogeneity and compaction.
B	Geology: Thickness, clay mineral, content and interface, particle size distribution, organic matter content, bulk density – heterogeneity of these geological parameters.
C	Water Table: orientation, unsaturated zone thickness, flow direction, seasonal fluctuation in unsaturated zone thickness.
D	Major Aquifer: An assumption has been made that the substance would not reach the Sherwood Sandstone due to the non-aquifer classification of the overlying Coleby mudstones, Froddingham ironstones, Scunthorpe mudstone group and Triassic Penarth group which are believed to prevent the migration of contaminants reaching the underlying major aquifer.
E	Recharge: Effective Recharge: Porosity, Permeability, flow velocity, dispersivity.
F	Unsaturated Zone Source Term: Residual oil contamination concentration and distribution, presence and volume and extent of free-product ponding on the water table and capillary fringe; solubility of different hydrocarbon species, viscosity, vapour pressure, density of the substance.
G	Dissolved Phase Plume: Existence, dimensions, orientation, concentrations, extent of natural attenuation process, speciation of hydrocarbons.
H	Degradation rates of this substance within soil and groundwater.
J	Methylation.
K	Presence of chemical groups that increase the affinity of a molecule for soil surfaces.
L	Plant uptake.

Figure1: Initial CSM

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
Crude tar	Zone 1A, Zone 1B, Zone 2A, Zone 6A and Zone 12.	1. Delivery by road tanker across the installation (Zone 12)	Spillage from road tanker on installation roads entering on site drainage system.	Infiltration of crude tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase crude tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Road tanker off-loading to storage (Zones 12, 1A and 1B)	Spillage from road tanker or delivery pipework entering on site drainage system.	Infiltration of crude tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase crude tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Storage (Zones 1A and 1B)	Failure of containment leading to spillage to land and or entering on site drainage system.	Infiltration of crude tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase crude tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		4. Transfer from storage by pipework and / or transfer pumps to various parts of the plant. (Zones 1A and 1B to Zones 2B and 6A over Zone 12)	Spillage from pipework or transfer pumps entering on-site drainage system.	Infiltration of crude tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase crude tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		5. Centrifuging and storage (Zones 1A and 6A)	Failure of containment leading to spillage to land and or entering on-site drainage system.	Infiltration of crude tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase crude tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		6. Distillation (Zone 2B)	Failure of containment leading to spillage to land and or entering on-site drainage system.	Infiltration of crude tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase crude tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Petroleum tar	Zone 1B, Zone 5 and Zone 12.	1. Delivery by road tanker across the installation (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system.	Infiltration of petroleum tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase petroleum tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Road tanker off-loading to storage (Zones 12, 1A and 1B)	Spillage from road tanker or delivery pipework entering on-site drainage system.	Infiltration of petroleum tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase petroleum tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Storage (Zones 1A and 1B)	Failure of containment leading to spillage on to land and or entering on-site drainage system.	Infiltration of petroleum tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase petroleum tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		4. Transfer from storage by pipework and / or transfer pumps. (Zones 1A and 1B to Zones 2B and 6A over Zone 12)	Spillage from pipework or transfer pumps entering on-site drainage system.	Infiltration of petroleum tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase petroleum tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		5. Centrifuging and storage (Zones 1A and 6A)	Failure of containment leading to spillage to land and or entering on-site drainage system.	Infiltration of petroleum tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase petroleum tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Xylene	Zone 6B and Zone 12	1. Delivery by road tanker across the installation (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system.	Infiltration of xylene into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase xylene towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Road tanker offloading to storage (Zones 12 and 6B)	Spillage from road tanker or delivery pipework entering on-site drainage system.	Infiltration of xylene into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase xylene towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Storage (Zone 6B)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of xylene into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase xylene towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		4. Transfer from storage by pipework and / or transfer pumps (Zone 6B)	Spillage from pipework or transfer pumps entering on-site drainage system.	Infiltration of xylene into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase xylene towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		5. Blending (Zone 6B)	Failure of containment leading to spillage to land and or entering on-site drainage system.	Infiltration of xylene into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase xylene towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Light oil	Zone 2B, Zone 4F and Zone 12	1. Transfer from distillation plant to storage (Zones 2B, 4F and 12)	Spillage from transfer pumps and pipework entering on-site drainage system.	Infiltration of light oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase light oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zone 4F)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of light oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase light oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Transfer from storage to road tanker (Zones 4F and 12)	Spillage from road tanker or delivery pipework entering on-site drainage system.	Infiltration of light oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase light oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		4. Transportation by road tanker (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system	Infiltration of light oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase light oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
Carbolic oil	Zone 2B, Zone 4B, Zone 4C and Zone 12	1. Transfer from Fractionation unit to storage (Zones 2B, 4C and 12)	Spillage from transfer pumps and pipework entering on-site drainage system.	Infiltration of carbolic oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase carbolic oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zones 4B and 4C)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of carbolic oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase carbolic oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Transfer from storage to road tanker (Zone 4B)	Spillage from road tanker or delivery pipework entering on-site drainage system.	Infiltration of carbolic oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase carbolic oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		4. Transportation by road tanker (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system	Infiltration of carbolic oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase carbolic oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Naphthalene oil	Zone 2B, Zone 4B, Zone 4C and Zone 12	1. Transfer from fractionation unit to storage (Zone 2B)	Spillage from transfer pumps and pipework entering on-site drainage system.	Infiltration of naphthalene oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase naphthalene oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zones 4B and 4C)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of naphthalene oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase naphthalene oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		3. Transfer from storage to road tanker (Zone 4B)	Spillage from road tanker or delivery pipework entering on-site drainage system.	Infiltration of naphthalene oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase naphthalene oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		4.Transportation by road tanker (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system	Infiltration of naphthalene oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase naphthalene oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Benzole absorbing oil	Zone B, Zone 4B, Zone 4C, Zone 4D and Zone 12	1. Transfer from fractionation plant to storage (Zones 2B, 4B, 4C and 4D)	Spillage from delivery pipelines, transfer pumps or road tanker entering on-site drainage system.	Infiltration of benzole absorbing oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase benzole absorbing oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zones 4B, 4C and 4D)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of benzole absorbing oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase benzole absorbing oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Transfer from storage to road tanker (Zone 4B and 4D)	Spillage from road tanker or delivery pipework entering on-site drainage system.	Infiltration of benzole absorbing oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase benzole absorbing oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		4. Transportation by road tanker (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system	Infiltration of benzole absorbing oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase benzole absorbing oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Anthracene oil	Zone 2B, Zone 4A, Zone 4C, Zone 4D, Zone 5 and Zone 6B	1. Transfer from Fractionation unit to storage (Zones 2B, 4C and 4D)	Spillage from transfer pumps and pipework entering on-site drainage system.	Infiltration of anthracene oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase anthracene oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zones 4C and 4D)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of anthracene oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase anthracene oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Transfer from storage to blenders and other areas (Zones 4A, 4D, 5 and 6B)	Spillage from transfer pumps and pipework entering on-site drainage system.	Infiltration of anthracene oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase anthracene oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Base oil	Zone 2B, Zone 4A, Zone 4C, Zone 4D, Zone 5 and Zone 6B	1. Transfer from fractionation unit to storage (Zones 2B, 4C and 4D)	Spillage from transfer pumps and pipework to entering on-site drainage system.	Infiltration of base oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase base oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zones 4C and 4D)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of base oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase base oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		3. Transfer from storage to blenders and other areas (Zones 4A, 4D, 5 and 6B)	Spillage from road tanker or delivery pipework entering on-site drainage system.	Infiltration of base oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase base oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Molten pitch	Zone 2A, Zone 2B, Zone 3A, Zone 3B, Zone 7 and Zone 12	1. Transfer from distillation still base to vacuum distillation (Zones 2A and 2B)	Spillage from transfer pumps and pipework entering on-site drainage system.	Infiltration of molten pitch into the subsurface soil / made ground. Pitch is stored as a liquid but if it leaks from the tank it will set on cooling. Therefore the migration of pitch is unlikely to occur.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Transfer from vacuum distillation to storage (Zones 2A, 3A and 3B)	Spillage from transfer pumps and pipework entering on-site drainage system.	Infiltration of molten pitch into the subsurface soil / made ground. Pitch is stored as a liquid but if it leaks from the tank it will set on cooling. Therefore the migration of pitch is unlikely to occur.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Storage (Zones 3A and 3B)	Failure of containment leading to a spillage to land	Infiltration of molten pitch into the subsurface soil / made ground. Pitch is stored as a liquid but if it leaks from the tank it will set on cooling. Therefore the migration of pitch is unlikely to occur.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		4. Transfer from storage to road tanker (Zones 3A and 12)	Spillage from delivery pipelines, transfer pumps or road tanker entering on-site drainage system.	Infiltration of molten pitch into the subsurface soil / made ground. Pitch is stored as a liquid but if it leaks from the tank it will set on cooling. Therefore the migration of pitch is unlikely to occur.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		5. Transportation by road tanker off site or to Zone 7 (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system	Infiltration of molten pitch into the subsurface soil / made ground. Pitch is stored as a liquid but if it leaks from the tank it will set on cooling. Therefore the migration of pitch is unlikely to occur.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		6. Transfer of molten pitch via pump to Zone 6B or Zone 5 for blending (Zones5, 6B and 12)	Failure of containment leading to a spillage to land	Infiltration of molten pitch into the subsurface soil / made ground. Pitch is stored as a liquid but if it leaks during transfer it will set on cooling. Therefore the migration of pitch is unlikely to occur.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		7. Pencil pitch (Zone 7)	Failure of containment leading to a spillage to land	Infiltration of solidified pitch into the subsurface soil / made ground. Solidified pitch unlikely to migrate.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Blended pitches and oils	Zone 3A, Zone 4E, Zone5, Zone 6B and Zone 12	1. Transfer from pitch storage to processing area (Zones 3A, 5 and 6B)	Spillage from transfer pumps and pipework entering on-site drainage system.	Infiltration of blended pitches and oils into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase blended pitches and oils towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Blending / mixing (Zones 5 and 6B)	Spillage from inline blender or mixers.	Infiltration of blended pitches and oils into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase blended pitches and oils towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Storage (Zones 4E and 6B)	Failure of containment leading to spillage to land	Infiltration of blended pitches and oils into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase blended pitches and oils towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		4. Tanker loading (Zones 4E, 6B and 12)	Spillage from road tanker or delivery pipework entering on-site drainage system	Infiltration of blended pitches and oils into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase blended pitches and oils towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		5. Transfer across site by road tanker (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system	Infiltration of blended pitches and oils into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase blended pitches and oils towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		6. Drum filling (Zone 6B)	Spillage from pipelines, transfer pumps entering on-site drainage system.	Infiltration of blended pitches and oils into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase blended pitches and oils towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		7. Drum storage (Zone 6B)	Failure of containment leading to spillage to land.	Infiltration of blended pitches and oils into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase blended pitches and oils towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		8. Transportation by lorry (Zone 6B and 12)	Spillage from drums on installation roads entering on-site drainage system	Infiltration of blended pitches and oils into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase blended pitches and oils towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Carbon black oil	Zone 4A and Zone 12	1. Storage (Zone 4A)	Failure of containment leading to spillage to land.	Infiltration of carbon black oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase carbon black oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		2. Transfer from storage to road tanker (Zones 4A and 12)	Spillage from delivery pipelines, transfer pumps or road tanker entering on-site drainage system.	Infiltration of carbon black oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase carbon black oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Transportation by road tanker (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system	Infiltration of carbon black oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase carbon black oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Thermia B oil	Zone 2B and Zone 12	1. Transportation by road in drums across the installation (Zone 12)	Spillage on installation roads entering on-site drainage system	Infiltration of Thermia B oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Thermia B oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage and handling (Zone 2B)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of Thermia B oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Thermia B oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Heavy fuel oil	Zone 9B and Zone 12	1. Transportation by road tanker across the site (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system.	Infiltration of heavy fuel oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase heavy fuel oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zone 9B)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of heavy fuel oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase heavy fuel oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		3. Transfer from storage for combustion (Zone 9B)	Spillage from delivery pipelines, transfer pumps entering on-site drainage system.	Infiltration of heavy fuel oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase heavy fuel oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Gas oil	Zone 2B, Zone 9B and Zone 12	1. Transportation by road tanker across the site (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system	Infiltration of gas oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase gas oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zones 2B and 9B)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of gas oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase gas oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Transfer from storage for combustion or road vehicle use (Zones 2B and 9B)	Spillage from delivery pipelines, transfer pumps entering on-site drainage system.	Infiltration of gas oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase gas oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Hydrochloric acid	Zone 2B, Zone 9B and Zone 12	1. Delivery in IBCs by lorry across the site (Zone 12)	Spillage from IBCs on installation roads entering on-site drainage system	Infiltration of hydrochloric acid into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase hydrochloric acid towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		2. IBC unloading (Zones 2B, 9B and 12)	Rupture / spillage from IBCs	Infiltration of hydrochloric acid into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase hydrochloric acid towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		3. Storage of IBCs (Zones 2B and 9B)	Failure of containment leading to spillage to drain	Infiltration of hydrochloric acid into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase hydrochloric acid towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		4. Transfer from storage to the HCl dosing system (Zones 2B and 9B)	Spillage from transfer pumps / pipeline entering on-site drainage system.	Infiltration of hydrochloric acid into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase hydrochloric acid towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Caustic soda pearl (solid)	Zone 9B and Zone 12	1. Transportation by road in bags across the installation (Zone 12)	Spillage on installation roads entering on-site drainage system	Infiltration of caustic soda into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase caustic soda towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		2. Storage and Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of caustic soda into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase caustic soda towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Caustic Soda 47% liquor	Zone 2B and Zone 12	1. Delivery by road tanker across the site (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system	Infiltration of caustic soda into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase caustic soda towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		2. Transfer from road tanker to storage (Zones 2B and 12)	Spillage from delivery pipelines, transfer pumps entering on-site drainage system.	Infiltration of caustic soda into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase caustic soda towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		3. Storage (Zone 2B)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of caustic soda into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase caustic soda towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		4. Transfer by pumps and pipelines (Zone 2B)	Spillage from transfer pumps and pipelines entering on-site drainage system.	Infiltration of caustic soda into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase caustic soda towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Nalco 43-63	Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Nalco 43-63 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Nalco 43-63 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Nalco 43-63 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Nalco 43-63 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Nalco 43-63 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Nalco 43-63 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Polyquest 5176	Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Polyquest 5176 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Polyquest 5176 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	Data unknown, details not provided by supplier

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Polyquest 5176 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Polyquest 5176 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	Data unknown, details not provided by supplier
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Polyquest 5176 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Polyquest 5176 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	Data unknown, details not provided by supplier
Optisperse PO5068	Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Optisperse PO5068 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Optisperse PO5068 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Optisperse PO5068 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Optisperse PO5068 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Optisperse PO5068 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Optisperse PO5068 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L
Optisperse ADJ5150	Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Optisperse ADJ5150 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Optisperse ADJ5150 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Optisperse ADJ5150 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Optisperse ADJ5150 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Optisperse ADJ5150 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Optisperse ADJ5150 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Spectrus NX1104	Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Spectrus NX1104 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus NX1104 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Spectrus NX1104 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus NX1104 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Spectrus NX1104 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus NX1104 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Spectrus NX1100	Zone 2B, Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Spectrus NX1100 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus NX1100 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		2. Storage (Zones 2B and 9B)	Failure of containment leading to spillage to land.	Infiltration of Spectrus NX1100 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus NX1100 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L
		3. Handling (Zones 2B and 9B)	Failure of containment entering on-site drainage system.	Infiltration of Spectrus NX1100 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus NX1100 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L
Spectrus NX1170	Zone 9B, Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Spectrus NX1170 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus NX1170 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Spectrus NX1170 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus NX1170 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Spectrus NX1170 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus NX1170 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Spectrus OX1200	Zone 9B, Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Spectrus OX1200 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus OX1200 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Spectrus OX1200 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus OX1200 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Spectrus OX1200 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus OX1200 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Spectrus OX1203	Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Spectrus OX1203 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus OX1203 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Spectrus OX1203 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus OX1203 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Spectrus OX1203 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Spectrus OX1203 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Steamate NA0840	Zone 9B, Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Steamate NA0840 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Steamate NA0840 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Steamate NA0840 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Steamate NA0840 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Steamate NA0840 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Steamate NA0840 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Cortrol IS3000E	Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Cortrol IS3000E into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Cortrol IS3000E towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Cortrol IS3000E into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Cortrol IS3000E towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Cortrol IS3000E into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Cortrol IS3000E towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Depositrol SF5101	Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Depositrol SF5101 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Depositrol SF5101 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Depositrol SF5101 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Depositrol SF5101 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Depositrol SF5101 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Depositrol SF5101 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L
Biomate 755	Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration of Biomate 755 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Biomate 755 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zone 9B)	Failure of containment leading to spillage to land.	Infiltration of Biomate 755 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Biomate 755 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Handling (Zone 9B)	Failure of containment entering on-site drainage system.	Infiltration of Biomate 755 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Biomate 755 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Continuum AT3225	Zone 2B, Zone 9B and Zone 12	1. Transportation by road in plastic containers across the installation (Zone 12)	Spillage from container on installation roads entering on-site drainage system	Infiltration Continuum AT3225 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Continuum AT3225 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		2. Storage (Zones 2B and 9B)	Failure of containment leading to spillage to land.	Infiltration Continuum AT3225 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Continuum AT3225 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L
		3. Handling (Zones 2B and 9B)	Failure of containment entering on-site drainage system.	Infiltration Continuum AT3225 into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Continuum AT3225 towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L
Raw effluent water	Zone 8	1. Storage	Failure of containment leading to spillage to land.	Infiltration of raw effluent water into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase raw effluent water towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
		2. Transfer from storage to Corus BETP via effluent pipeline.	Failure of containment leading to spillage to land.	Infiltration of raw effluent water into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase raw effluent water towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Pitch / oil slops	Zone 1B and Zone 2B	1. Transfer to storage (Zone 2B)	Spillage from pipelines entering on-site drainage system	Infiltration of pitch / oil slops into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase pitch / oil slops towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zone 2B)	Failure of containment leading entering on-site drainage system	Infiltration of pitch / oil slops into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase pitch / oil slops towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		3. Transfer to coal tar storages (Zones 1B and 2B)	Spillage from pipelines entering on-site drainage system	Infiltration of pitch / oil slops into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase pitch / oil slops towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Wash out oil	Zone 1A and Zone 6A	1. Flushing of plant and transfer to storage (Zone 6A)	Spillage from pipelines entering on-site drainage system	Infiltration of wash out oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase wash out oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zone 6A)	Failure of containment leading to spillage entering on-site drainage system	Infiltration of wash out oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase wash out oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Transfer back to coal tar tanks for reprocessing (Zones 1A and 6A)	Spillage from pipelines entering on-site drainage system	Infiltration of wash out oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase wash out oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Fractionator effluent	Zone 2B and Zone 12	1. Transfer from distillation unit to storage (Zone 2B)	Spillage from delivery pipelines, transfer pumps entering on-site drainage system	Infiltration of fractionator effluent into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase fractionator effluent towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage (Zone 2B)	Failure of containment leading to spillage entering on-site drainage system.	Infiltration of fractionator effluent into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase fractionator effluent towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
		3. Transfer to tanker (Zones 2B and 12)	Spillage from drainage lines entering on-site drainage system	Infiltration of fractionator effluent into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase fractionator effluent towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		4. Transportation by road tanker (Zone 12)	Spillage from road tanker on installation roads entering on-site drainage system	Infiltration of fractionator effluent into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase fractionator effluent towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Shell Vitrea oil	Zone 10 and Zone 12	1. Transportation by road in drums across the installation (Zone 12)	Spillage from drum on installation roads entering on-site drainage system	Infiltration of Shell Vitrea oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Shell Vitrea oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage and handling (Zone 10)	Failure of containment entering on-site drainage system.	Infiltration of Shell Vitrea oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Shell Vitrea oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Shell Super motor oil	Zone 10 and Zone 12	1. Transportation by road in drums across the installation (Zone 12)	Spillage from drum on installation roads entering on-site drainage system	Infiltration of Shell Super motor oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Shell Super motor oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Storage and handling (Zone 10)	Failure of containment entering on-site drainage system.	Infiltration of Shell Super motor oil into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase Shell Super motor oil towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
Ammoniacal liquor	Zone 1A, Zone 1B and Zone 12	1. Storage / settling (Zones 1A and 1B)	Failure of containment leading to spillage to land.	Infiltration of ammoniacal liquor into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase ammoniacal liquor towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Transfer by drainage lines to effluent storage tank (Zone 12)	Spillage from drainage lines to land.	Infiltration of ammoniacal liquor into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase ammoniacal liquor towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Crude tar solids	Zone 1A, Zone 1B and Zone 12	1. Removal from fractionating columns and tanks to storage (Skips) (Zones 1A and 1B)	Failure of containment entering on-site drainage system.	Infiltration of crude tar solids into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase crude tar solids towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		2. Temporary skip storage (Zones 1A and 1B)	Failure of containment entering on-site drainage system.	Infiltration of crude tar solids into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase crude tar solids towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
		3. Skip road transportation across the site (Zone 12)	Spillage during transportation on installation roads entering on-site drainage system	Infiltration of crude tar solids into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase crude tar solids towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Municipal waste – exact composition of waste unknown	Exact location unknown – covers most of site	Unknown Historical Contaminants	Municipal landfill site	Infiltration of contaminants from the municipal landfill site into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase contaminants from the municipal landfill site towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to L

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
Benzene	Note 1	Unknown Historical Contaminants	Loss of containment of benzene from historical processes located on site.	Infiltration of benzene into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase benzene towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Note 1: Exact location unknown however on the basis of the historical information provided it can be predicted that benzene contamination may potentially be present anywhere on site but is more likely to be found at the southern end of the site.						
Toluene	Note 2	Unknown Historical Contaminants	Loss of containment of toluene from historical processes located on site.	Infiltration of toluene into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase toluene towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Note 2: Exact location unknown however on the basis of the historical information provided it can be predicted that toluene contamination may potentially be present anywhere on site.						
Xylene	Note 3	Unknown Historical Contaminants	Loss of containment of xylene from historical processes located on site.	Infiltration of xylene into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase xylene towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Note 3: Exact location unknown however on the basis of the historical information provided it can be predicted that xylene contamination may potentially be present anywhere on site.						
Coal tar	Note 4	Unknown Historical Contaminants	Storage of waste coal tar from historical processes located on site.	Infiltration of coal tar into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase coal tar towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Note 4: Exact location of acid tar lagoon unknown however on the basis of historical information provided it can be predicted that coal tar contamination may potentially be present at the northern end of the site.						
Naphthalene	Note 5	Unknown Historical Contaminants	Storage of waste naphthalene from historical processes located on site.	Infiltration of naphthalene into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase naphthalene towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
Note 5: Exact location of acid tar lagoon unknown however on the basis of historical information provided it can be predicted that naphthalene contamination may potentially be present at the northern end of the site.						
Phenols	Exact location unknown	Unknown Historical Contaminants	Historic contamination from gas works	Infiltration of phenols into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase phenols towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Cyanides	Exact location unknown	Unknown Historical Contaminants	Historic contamination from gas works	Infiltration of cyanides into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase cyanides towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Sulphur	Exact location unknown	Unknown Historical Contaminants	Historic contamination from gas works	Infiltration of sulphur into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase sulphur towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Spent oxide	Exact location unknown	Unknown Historical Contaminants	Historic contamination from gas works	Infiltration of spent oxide into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase spent oxide towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Foul lime	Exact location unknown	Unknown Historical Contaminants	Historic contamination from gas works	Infiltration of foul lime into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase foul lime towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L

Substance	Zone	Relevant Activities	Source	Pathway	Receptor	Uncertainties
Polyaromatic hydrocarbons (PAHs)	Exact location unknown	Unknown Historical Contaminants	Historic contamination from gas works	Infiltration of PAHs into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase PAHs towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K
Ammonia	Exact location unknown	Unknown Historical Contaminants	Historic contamination from gas works	Infiltration of ammonia into the subsurface soil / made ground. Vertical migration of free phase and dissolved phase ammonia towards any shallow water table, followed by lateral migration preferentially through the permeable units in the made ground and alluvium. Flow is likely to occur towards the north and east of the site.	Soil Perched Groundwater River Trent Ecological Receptors*	A to E, J, K, L
Solidified pitch	Exact location unknown	Unknown Historical Contaminants	Historic contamination from gas works	Infiltration of solidified pitch into the subsurface soil / made ground. Solidified pitch unlikely to migrate.	Soil Perched Groundwater River Trent Ecological Receptors*	A to H, K

* The ecological receptors include the designated nature conservation sites discussed in Section 2.5.3 of Ref. [1], all of which support internationally and nationally important habitat

APPENDIX B: Investigation and Sampling Protocols

Appendix B1: Soil

This appendix provides an outline of the sampling and analytical protocols to be used to obtain and characterise representative soil samples. A formal procedure following this outline will be issued following the approval of the SPMP by the EA. Samples will be collected from the surface and subsurface soil in accordance with the proposed investigation and sampling strategy detailed in Section 3.1.3. Samples will be analysed for the indicator substances listed in Table C1 of Appendix C.

Sampling Equipment

It is recommended that soil cores are taken from the eight new boreholes using cable percussive drilling. The percussive drilling technique is suitable for use in a wide variety of ground materials including gravel, sand, silt and clay. It is also operable to considerable depths and is capable of operating both above and below the water table.

Cable percussive drilling is carried out using a rig consisting of a three leg A frame and a winch for lifting the drilling tools to a specific height and allowing them to free fall. The borehole is advanced through percussive action using drilling tools such as a shell (or bailer) for granular soils, clay cutter for dry cohesive soils and a chisel for breaking up rock and other hard layers. If the soil itself is not self supporting a 150mm diameter steel casing will be driven into the ground to support the soil.

Soil Sampling Methods

Prior to sampling all surface materials that are not to be included in the sample should be removed (e.g. leaves, traces of tarmac etc.).

Following checks for underground services and pipelines, if appropriate proceed with the borehole using casing (usually 150mm in diameter) and cable percussive drilling. Clay cutters will be used in clays and shell in sand. Bulk samples will be taken from the clay cutter / shell in bags. Undisturbed samples will be taken in a U100 sampler or SPT split cone. Samples will be taken at 0.5 metre intervals. SPT tests will be undertaken in sands and granular material, SPT with the use of a cone will be used in coarse gravel, cobbles and fill and the U100 sampler in clays.

Sample Identification

Samples collected for laboratory analysis will be identified by labelling the sample containers. The following information will be included on the sample labels and / or in the sampling report:

- project name;
- field identification and depth interval of the sample;
- date and time of sample collection;
- designation of a sample as a grab or composite;
- the signature of the sampler;
- the sample preservation used; and
- the general type of analyses to be performed.

Chain of Custody Record

The field chain of custody record will be used to record custody of all samples collected and maintained by the field personnel. The record transfers custody of samples from the field personnel, to another person, to the laboratory or other organisations such as couriers. The chain of custody record will be simplified by minimising the number of people who have custody of the samples. The record will also serve as a sample logging mechanism for the laboratory sample custodian. The following information shall be supplied on the field chain of custody record which accompanies the samples to the laboratory:

- the project name;
- the signature of all samplers must be in the designated signature block;
- the sample designation;
- sample date;
- time of sample collection;
- whether the sample was a grab or composite sample; and
- any remarks or any other pertinent information to be used by the laboratory, such as turn-around time or quality control.

Packaging and Shipment of Samples

The samples will be properly packaged upright using packaging provided by the laboratory to minimise the potential for breakage, leakage, cross contamination and to ensure that samples are maintained at the correct temperature ($4^{o}C$) for preservation purposes. All samples will be inventoried and checked to ensure that information is entered correctly on the chain of custody form.

To ensure that the storage container is not tampered with prior to receipt at the laboratory, chain of custody tape (signed and dated) should be placed in two different locations (front and back) on the container lid and overlapped with transparent packaging tape.

Sample shipment will be via a courier who can guarantee delivery within 24 hours. All shipment records will be retained for the project files.

Quality Control / Quality Assurance Samples

Quality control samples will be collected during the field sampling to evaluate the field and laboratory variability. The following types of sample will be taken:

Duplicate Samples – Duplicate samples will be taken from soil collected from a common source to determine the variability of a given constituent following laboratory analysis. One duplicate sample will be taken for each borehole.

Decontamination

All sampling equipment will be decontaminated prior to use and between each sample collection point. Waste products produced by the decontamination procedures such as rinse liquids, solids, paper towels, gloves etc. will be collected and disposed of properly. The following steps will be used to decontaminate all soil sampling equipment:

- Remove gross contamination from the equipment by brushing then rinsing with tap water.
- Wash with a detergent or soap solution.
- Rinse with tap water.
- Rinse with laboratory grade methanol.
- Rinse with distilled water (provided by the laboratory).
- Repeat the entire procedure or any part of the procedure as necessary.
- After decontamination procedure is completed, avoid placing equipment directly on the ground surface to avoid re-contamination. Sampling equipment may be wrapped in aluminium foil or plastic if necessary.

Appendix B2: Groundwater

This appendix provides an outline of the sampling and analytical protocols to be used to obtain and characterise representative groundwater samples. A formal procedure following this outline will be issued following the approval of the SPMP by the EA. Samples will be collected in accordance with the proposed investigation and sampling strategy detailed in Section 3.1.4. Samples will be analysed for the indicator substances listed in Table C1 of Appendix C.

Sampling Equipment

The water level will be monitored by dip meter prior to pumping water out of the well.

Either a battery-operated electric submersible pump or a peristaltic pump (depending on water levels in the borehole) will be used to collect the water samples from the boreholes.

Groundwater Sampling Methods

Prior to sampling the condition of the surface seal and well protector should be examined to see if there is any evidence of frost-heaving, cracks or vandalism, any such observations will be recorded in the sampling report. The area surrounding the well may have to be cleared of weeds or other materials prior to sampling. A drop cloth should be placed on the ground around the well head (especially if it is contaminated or disturbed) to avoid the equipment coming in contact with the ground. This will reduce the amount of time required for cleaning the equipment.

The well protector and cap should be removed from the top of the well. The groundwater level in the wells will then be measured using a dip meter from the top of the well.

The sample pumps will be run in the well for approximately 3 minutes to purge the well before collecting the sample.

At least 1 litre of groundwater will be collected per sample from the boreholes (larger samples may be required depending on the requirements of the laboratory). Two or three sets of samples will be taken over a short period of time (separated by a few weeks) and these water samples will be transferred directly into the appropriate laboratory supplied labelled container, logged and transferred to the laboratory for analysis. One member of the sampling team will oversee the preparation of the samples to ensure they are correctly preserved and labelled. They will also be responsible for completing the sampling report.

Any waste water that may be contaminated will be disposed of in a responsible manner.

Sample Identification

Samples collected for laboratory analysis will be identified by labelling the sample containers. The following information will be included on the sample labels and / or in the sampling report:

- project name;
- field identification and depth interval of the sample;
- date and time of sample collection;
- the signature of the sampler;
- the sample preservation used; and
- the general type of analyses to be performed.

Chain of Custody Record

The field chain of custody record will be used to record custody of all samples collected and maintained by the field personnel. The record transfers custody of samples from the field personnel, to another person, to the laboratory or other organisations such as couriers. The chain of custody record will be simplified by minimising the number of people who have custody of the samples. The record will also serve as a sample logging mechanism for the laboratory sample custodian. The following information shall be supplied on the field chain of custody record which accompanies the samples to the laboratory:

- the project name;
- the signature of all samplers must be in the designated signature block;
- the sample designation;
- sample date;
- time of sample collection; and
- any remarks or any other pertinent information to be used by the laboratory, such as turn-around time or quality control.

Packaging and Shipment of Samples

The samples will be properly packaged upright using packaging provided by the laboratory to minimise the potential for breakage, leakage, cross contamination and to ensure that samples are maintained at the correct temperature ($4^{o}C$) for preservation purposes. All samples will be inventoried and checked to ensure that information is entered correctly on the chain of custody form.

To ensure that the storage container is not tampered with prior to receipt at the laboratory, chain of custody tape (signed and dated) should be placed in two different locations (front and back) on the container lid and overlapped with transparent packaging tape.

Sample shipment will be via a courier who can guarantee delivery within 24 hours. All shipment records will be retained for the project files.

Quality Control / Quality Assurance Samples

Quality control samples will be collected during the field sampling to evaluate the field and laboratory variability. The following types of sample will be taken:

Duplicate Samples – Duplicate samples will be taken from water collected from a common source to determine the variability of a given constituent following laboratory analysis. One duplicate sample will be taken for each set of samples taken at the site.

Field Blanks – Deionised water will be added to a sample container on site and transported to the laboratory with the other containers. Field blanks will monitor any contamination that may have occurred in the field. One field blank will be taken for each set of samples.

Decontamination

All sampling equipment will be decontaminated prior to use and between each sample collection point. Waste products produced by the decontamination procedures such as rinse liquids, solids, paper towels, gloves etc. will be collected and disposed of properly. The following steps will be used to decontaminate all water sampling equipment:

- Remove gross contamination from the equipment by rinsing with tap water.
- Wash with a detergent or soap solution.
- Rinse with tap water.
- Rinse with laboratory grade methanol.
- Rinse with distilled water (provided by the laboratory).
- Repeat the entire procedure or any part of the procedure as necessary.
- After decontamination procedure is completed, avoid placing equipment directly on the ground surface to avoid re-contamination. Sampling equipment may be wrapped in aluminium foil or plastic if necessary.

Appendix B3: Infrastructure

The procedures for the inspection and maintenance of sub-surface structures, surface finishes and storage tanks and pipelines are being written as part of the improvement programme detailed in Ref. [3] and will be appended to the SPMP when they are issued.

A copy of the procedure for the inspection and maintenance of bunds is provided below.

APPENDIX C: Analytical Protocols and Laboratory Accreditation

Appendix C1: Tables

Table C1: Chemicals of Potential Concern and Indicator Substances

CoPCs	Indicator Substance
Crude Tar / Crude Tar Solids	TPH, PAH, BTEX
Petroleum Tar	TPH, PAH, BTEX
Raw Effluent Water	This will contain dilute amounts of other CoPCs
Light Oil	TPH, PAH, BTEX
Carbolic Oil	TPH, PAH, BTEX
Naphthalene Oil	TPH, PAH, BTEX
Anthracene Oil	TPH, PAH, BTEX
Base Oil	TPH, PAH, BTEX
Pitch / Solidified Pitch	TPH, PAH, BTEX
Blended Pitches and Oils / Pitch and Oil Slops	TPH, PAH, BTEX
Carbon Black Oil	TPH, PAH, BTEX
Benzole Absorbing Oil	TPH, PAH, BTEX
Heavy Fuel Oil	TPH, PAH, BTEX
Gas Oil (Diesel)	TPH, PAH, BTEX
Shell Vitrea Oil	TPH, PAH, BTEX
Shell Super Motor Oil	TPH, PAH, BTEX
Thermia B Oil	TPH, PAH, BTEX
Sodium Hydroxide (Caustic soda pearls and liquor)	pH, Na^+ ions
Nalco 43-63	pH, PO_4^{2-} ions
Polyquest 5176	pH, PO_4^{2-} ions
Optisperse PO5068	PO_4^{2-} ions
Optisperse ADJ5150	pH, Na^+ ions
Spectrus NX1104	NH_4^+ ions, Cl^- ions
Spectrus NX1100 (Biocides)	NO_4^{2-} ions
Spectrus NX1170 (Biocides)	SCN^-
Spectrus OX1200 (Biocides)	Br^- ions, Cl^- ions
Spectrus OX1203	Br^- ions, Cl^- ions
Steamate NA0840	SVOC (TIC – ethanolamine)
Cortrol IS3000E	Na^+ ions
Depositrol SF5101	Phenolic compounds
Biomate 755	Na^+ ions, CN^- ions
Continuum AT3225	PO_4^{2-} ions
Ammoniacal Liquor / Ammonia	NH_4^+ ions
Hydrochloric Acid	pH, Cl^- ions
Phenols	Phenolic compounds
Cyanide	CN^- ions
Sulphur	Sulphur (total)
Xylene	BTEX
Spent Oxide	CN^- ions (total), Fe
Foul Lime	Ca^{2+}
PAHs	PAH

CoPCs	Indicator Substance
Wash Out Oil	TPH, PAH, BTEX
Fractionator Effluent	Sulphide, CN^- ions
Benzene	BTEX
Toluene	BTEX
Municipal Waste (heavy metals)	Cu^+ ions, Ni^+ ions, Pb^{2+} ions

Appendix C2: Analytical Techniques

Table C2a: Proposed Analytical Techniques – Soil

Indicator Substance	Method*	UKAS	MCERTS	Method Reporting Limit
TPH	IHM DCM extract of the "as received" sample / GCFID	Yes	No	10mg/kg
PAH	IHM based on EPA 8100 / solvent extraction, determination by GCFID	Yes	No	1mg/kg
BTEX	IHM by headspace GCFID	Yes	No	0.01mg/kg
pH	IHM pH electrode or equivalent.	Yes	No	N/A
Na^{+} ions	IHM Aqua regia extract / ICPOES determination	No	No	1mg/kg
PO_4^{2-} ions (as phosphorous)	IHM based on BS7755 / colorimetric detection	No	No	1mg/kg
NO_4^{2-} ions	IHM based on MAFF Method 52. Saturated $CaSO_4$ extract / nitrite electrode.	Yes	No	1.2mg/kg
SCN^{-}	IHM water extract / flow injection colorimetric analysis of extract using ferric nitrate chemistry	Yes	Yes	0.5mg/kg
Br^{-} ions	IHM water extract / bromide electrode	No	No	2mg/kg
NH_4^{+} ions	IHM based on MAFF Method 53. Extract with 2M KCl / FIA	Yes	No	0.5mg/kg
Cu^{+} ions	IHM Aqua regia extract / ICPMS determination	Yes	No	0.5mg/kg
Ni^{+} ions	IHM Aqua regia extract / ICPMS determination	Yes	No	0.5mg/kg
Pb^{+} ions	IHM Aqua regia extract / ICPMS determination	Yes	No	0.5mg/kg
Cl^{-} ions	IHM 5:1 water extraction. FIA using mercuric thiocyanate chemistry	No	No	5mg/kg
Phenols	IHM distillation / 4-aminoantipyrene	Yes	No	2mg/kg
CN^{-} ions	IHM pH1 distillation / ion chromatography	Yes	No	1mg/kg
Sulphur (total)	IHM combustion / furnace	Yes	No	0.01%
SVOC (TIC's)	Soxhlet extraction followed by GCMS. TIC's are reported based on the best fit from library search-match and semiquantified against EPA 8260 internal standards assuming a response factor of 1.	Yes	No	0.05mg/kg
Fe	IHM Aqua regia extract / ICPOES determination	No	No	6mg/kg
Ca^{2+}	IHM Aqua regia extract / ICPOES determination	No	No	1mg/kg

Indicator Substance	Method*	UKAS	MCERTS	Method Reporting Limit
Sulphide	IHM acid distillation / ion chromatography	Yes	No	5mg/kg

* These are the proposed methods to be used for analysis however, alternative equivalent methods may be used. Alternative methods may also have slightly different reporting limits.

Table C2b: Proposed Analytical Techniques – Water

Indicator Substance	Method*	UKAS	Method Reporting Limit
TPH	IHM DCM extract of the “as received” sample / GCFID	Yes	0.1mg/l
PAH	IHM based on EPA 8100 solvent extraction, determination by GCFID	Yes	0.01mg/l
BTEX	IHM by headspace GCFID	Yes	0.005mg/l
pH	IHM using pH electrode	Yes	N/A
Na^+ ions	IHM determination by ICPOES	Yes	0.01mg/l
PO_4^- ions	IHM method by discrete colorimetry	Yes	0.01mg/l
NO_4^{2-} ions	IHM calculated from total oxidised nitrogen and nitrite	Yes	0.3mg/l
SCN^-	IHM method by discrete colorimetry	Yes	0.1mg/l
Br^- ions	IHM bromide electrode	No	1mg/l
NH_4+ ions	IHM method by discrete colorimetry	Yes	0.01mg/l
Cu^+ ions	IHM determination by ICPOES	Yes	0.01mg/l
Ni^+ ions	IHM determination by ICPOES	Yes	0.02mg/l
Pb^+ ions	IHM determination by ICPOES	Yes	0.03mg/l
Cl^- ions	IHM method by discrete colorimetric analysis	Yes	1mg/l
Phenols	Segmented flow analysis incorporating distillation / 4-aminoantipyrene	No	0.05mg/l
CN^- ions	IHM acid distillation followed by ion chromatography	Yes	0.1mg/l
Sulphur (total)	IHM determination by ICPOES	Yes	0.06mg/l
SVOC (TIC’s)	Liquid-liquid extraction followed by GCMS. TIC’s are reported based on the best fit from library search-match and semiquantified against EPA 8270 internal standards assuming a response factor of 1.	Yes	Approx. 0.025mg/l
Fe	IHM determination by ICPOES	Yes	0.01mg/l
Ca^{2+}	IHM determination by ICPOES	Yes	0.01mg/l
Sulphide	IHM sulphide electrode	Yes	0.2mg/l

* These are the proposed methods to be used for analysis however, alternative equivalent methods may be used. Alternative methods may also have slightly different reporting limits.

APPENDIX D: Quality Assurance and Quality Protocol

Appendix D1: Sampling and Analytical Quality Assurance and Quality Control Plan

This appendix provides an outline of the sampling and analytical quality assurance (QA) and quality control (QC) plan to be used to obtain and characterise representative soil and groundwater samples. A formal procedure following this outline will be issued following the approval of the SPMP by the EA.

Personnel responsible for sampling will be trained in environmental monitoring to an appropriate level to ensure competence in the collection of soil and groundwater samples and to ensure compliance with the quality assurance and quality control plan. If necessary a qualified and experienced contractor will be used to take the samples and provide training for Koppers personnel.

The samples will be analysed by a third party accredited laboratory (MCERTS accredited for soil and preferably UKAS accredited for groundwater). Following the analysis of the samples the supporting QA / QC documentation for the laboratory (which shows that the analysis was performed within acceptable parameters and under appropriate quality conditions) will be appended to this SPMP.

Quality control will be achieved through the use of duplicate analysis (for each set of samples) and field blanks (for each set of samples) for groundwater analysis and duplicate analysis (for each borehole) for soil sample analysis.

Duplicate Analysis – The same sample is put into two different containers. The samples will not be identified as duplicates. The results should be within accepted error limits.

Field Blanks – Deionised water is added to a sample container on site and transported to the laboratory with the other containers. If the blank is contaminated this may indicate unclean containers or poor handling techniques.

During sampling all the work carried out and any observations made will be recorded in a sampling report. Details of the information to be included in the sampling report are provided in Appendix E1.

Any analytical data collected during the investigation and results from the laboratory analysis will be recorded in a spreadsheet or database and updated regularly, by a dedicated custodian, when further monitoring results are obtained. This will ensure that a complete and accurate record of borehole monitoring is maintained.

A chain of custody will be maintained throughout the lifetime of the sample. Before the samples are dispatched from the site and when they are received at the laboratory the details on the container will be checked against the sample report and the chain of custody documents.

Samples will be stored in appropriate containers provided by the laboratory, labelled and kept in a cool area, out of sunlight and away from heat. Advice will be sought from the laboratory to ensure that appropriate preservation and handling techniques are used in order to minimise the potential for chemical or biological changes to take place prior to analysis.

Standard reporting templates will be established to ensure consistency in the way results are reported and to enable results to be easily interpreted and reviewed.

APPENDIX E: Inspection and Monitoring Protocols

Appendix E1: Environmental Monitoring Protocols

The groundwater monitoring strategy requires the maintenance of on-site boreholes.

E1.1 Frequency and Timing of Monitoring

It is proposed to sample groundwater from available boreholes on an annual basis. Two or three sets of samples will be taken over a short period of time (i.e. separated by a few weeks) each year. Groundwater samples will be analysed using the determinants detailed in Appendix C1. If the initial investigation or ongoing analysis shows the presence of significant increases in concentrations or distributions of chemicals of potential concern or their respective indicator substances the sampling frequency will be increased as necessary.

E1.2 Emergency Monitoring Plan

An emergency monitoring plan will be implemented if:

- there is an incident at the installation resulting in an emission to land;
- pollution is identified from environmental monitoring during the operation of the installation or increasing from reference data levels;
- reference data shows pollution that is attributed to non-permitted sources.

In the event of an emergency the frequency of groundwater monitoring will be increased to facilitate the identification of the source and extent of the pollution. Increased monitoring will also assist in determining whether remediation is required under the PPC Regulations.

E1.3 Sampling Protocols

Collection

The groundwater samples will be taken from the new boreholes which have been identified as being appropriate for ongoing monitoring. Samples will be taken using a battery-operated electric submersible pump unless the water level in the borehole is low in which case a peristaltic pump will be used. The sample pumps will be run to purge the well before collecting the sample. This will remove standing water within the well in order to obtain a representative sample from the aquifer.

At least one litre of groundwater will be collected from each borehole. Two or three sets of samples will be taken over a short period of time (separated by a few weeks).

Water samples should be taken in a manner to minimise / eliminate the potential for cross contamination. Cross contamination can be minimised by ensuring that the monitoring borehole is sealed, capped and locked in an appropriate manner when not in use. Equipment used for purging or sampling groundwater should be washed before use in each borehole in order to minimise the likelihood of cross contamination. In order to avoid the process of decontamination dedicated purging / sampling equipment could be purchased for each monitoring borehole.

The person taking the sample should record details of the samples on the containers at the time of collection. A sampling report should also be maintained and should include where applicable the following information:

- location and name of sampling site with co-ordinates and other relevant locational information including ground levels;
- details of actual sampling locations, including co-ordinates and depth;
- date of collection;
- method of collection;
- time of collection;
- name of collector;
- weather conditions;
- nature of any pre-treatment;
- barometric pressure;
- ambient temperature; and
- any other data or observations gathered during the sampling process.

Preservation

Water samples should be collected in PET (polyethylene terephthalate) and / or glass bottles as appropriate. Advice from the laboratory should be sought to ensure the appropriate preservation and handling techniques are used. This will ensure that any specific requirements related to analytical techniques are taken into consideration. The samples will be stored in a cool area, out of sunlight and away from heat until the analysis is conducted.

Handling and Storage

Once a sample is obtained it should be clearly and uniquely labelled in accordance with the classification scheme detailed in Section 3.2. The container should be labelled on the side and on the lid. The sample container should be labelled by either writing directly on the container or by attaching a label to the container. It should be ensured that the labels are resistant to external influences (e.g. rain and contamination) and to future treatment (e.g.

handling and contact with chemicals). Some commercially available adhesive labels and marker pens contain organic solvents; care should be taken to ensure that the water sample does not become contaminated by these materials.

Before the samples are dispatched from the site and when they are received at the laboratory the details on the container (and lid) should be checked against the sample report and chain of custody documents.

Carriers of samples between the site and to the laboratory should be aware of the identity of the materials they are carrying. Samples should be transported to the laboratory as soon as possible to minimise any potential for chemical or biological changes to take place before examination.

E1.4 Analytical Suites

The groundwater samples will be tested for the chemicals of potential concern, identified in the Application Site Report Annex (including Phase 1a Site Report), listed below.

CoPCs	Indicator Substance
Crude Tar / Crude Tar Solids	TPH, PAH, BTEX
Petroleum Tar	TPH, PAH, BTEX
Raw Effluent Water	This will contain dilute amounts of other CoPCs
Light Oil	TPH, PAH, BTEX
Carbolic Oil	TPH, PAH, BTEX
Naphthalene Oil	TPH, PAH, BTEX
Anthracene Oil	TPH, PAH, BTEX
Base Oil	TPH, PAH, BTEX
Pitch / Solidified Pitch	TPH, PAH, BTEX
Blended Pitches and Oils / Pitch and Oil Slops	TPH, PAH, BTEX
Carbon Black Oil	TPH, PAH, BTEX
Benzole Absorbing Oil	TPH, PAH, BTEX
Heavy Fuel Oil	TPH, PAH, BTEX
Gas Oil (Diesel)	TPH, PAH, BTEX
Shell Vitrea Oil	TPH, PAH, BTEX
Shell Super Motor Oil	TPH, PAH, BTEX
Thermia B Oil	TPH, PAH, BTEX
Sodium Hydroxide (Caustic soda pearls and liquor)	pH, Na^{+} ions
Nalco 43-63	pH, PO_4^{2-} ions
Polyquest 5176	pH, PO_4^{2-} ions
Optisperse PO5068	PO_4^{2-} ions
Optisperse ADJ5150	pH, Na^{+} ions
Spectrus NX1104	NH_4^{+} ions, Cl^{-} ions
Spectrus NX1100 (Biocides)	NO_4^{2-} ions
Spectrus NX1170 (Biocides)	SCN^{-}

CoPCs	Indicator Substance
Spectrus OX1200 (Biocides)	Br^- ions, Cl^- ions
Spectrus OX1203	Br^- ions, Cl^- ions
Steamate NA0840	SVOC (TIC – ethanolamine)
Cortrol IS3000E	Na^+ ions
Depositrol SF5101	Phenolic compounds
Biomate 755	Na^+ ions, CN^- ions
Continuum AT3225	PO_4^{2-} ions
Ammoniacal Liquor / Ammonia	NH_4^+ ions
Hydrochloric Acid	pH, Cl^- ions
Phenols	Phenolic compounds
Cyanide	CN^- ions
Sulphur	Sulphur (total)
Xylene	BTEX
Spent Oxide	CN^- ions (total), Fe
Foul Lime	Ca^{2+}
PAHs	PAH
Wash Out Oil	TPH, PAH, BTEX
Fractionator Effluent	Sulphur (total), CN^- ions
Benzene	BTEX
Toluene	BTEX
Municipal Waste (heavy metals)	Cu^+ ions, Ni^+ ions, Pb^{2+} ions

E1.5 Analytical Protocols

There may be the requirement for pre-treatment of the water samples depending on the nature of the sample. Where any pre-treatment is conducted on site it should be identified on the sample containers and in the sample records. Water samples should be stabilised by cooling to 4 – 6^{o}C and analysed as soon as possible especially if unstable contaminants are present.

Details of sample preparation and analysis will be provided once a laboratory has been selected following the approval of the SPMP by the EA. The SPMP will then be updated accordingly.

E1.6 Quality Control and Quality Assurance

Sample Collection

Samples will be collected by a designated member of staff from Koppers who has been appropriately trained in the collection of groundwater samples from the monitoring wells.

Sample Analysis

The samples will be analysed by a UKAS accredited laboratory. A laboratory will be selected following the approval of the SPMP by the EA. Details of the laboratory's quality control / quality assurance system will then be appended to the SPMP.

E1.7 Maintenance of Monitoring Infrastructure

The monitoring infrastructure will initially be inspected on a six monthly basis until a suitable inspection regime can be determined based upon these initial results.

The actual procedure for the maintenance of boreholes will be established once the drilling has been conducted and the exact nature of the boreholes is known.

E1.8 Roles and Responsibilities

The Works Manager (who is suitably qualified) has overall responsibility for the implementation of the environmental monitoring programme. All the work required to satisfy the objectives of the monitoring programme will be undertaken by suitably trained individuals. An organogram for the site is provided overleaf.

Appendix E2: Infrastructure Monitoring Protocols

Not applicable. Adequate infrastructure monitoring procedures will be in place once the improvements identified in Ref. [3] are completed.

Details of the roles and responsibilities for infrastructure monitoring can be found in Section 2.3.1 of Ref. [3].

Appendix E3: Data Recording and Reporting Procedures

Responsibilities

The Works Manager has responsibility for effective communication within and external to the company.

Internal Correspondence

Notification of any specific issues will be covered verbally or in writing where appropriate.

External Correspondence

The Works Manager is responsible for replying to received letters and complaints on all matters concerning environmental issues. Any visits by e.g. the EA are recorded when relevant. All problems are reviewed by the Works Manager if necessary and action taken accordingly.

Emergency Reporting Procedures

An emergency response plan has been established to cover emergency situations and actions with reference to major spillages, fire and explosions.

In the event of an environmental incident, accidents and potential emergency situations the following persons are responsible for the implementation of the plan:

- Site Main Controller – The Works Manager or named deputy who can be summoned to an emergency in 1 hour if not already on site. An appropriate deputy is available 24 hours a day.
- Incident Controller – The Production Manager, with the Site Health and Safety Manager or Works Chemist acting as deputy, who can be summoned to an emergency in 1 hour if not already on site. An appropriate deputy is available 24 hours a day.

Full details of responsibilities in the event of an emergency can be found in the COMAH Safety Report, 2003.

The accident investigation procedures include environmental issues. All relevant staff would participate in the investigation of the incident / accident and the results of the investigation would be circulated to all relevant personnel.

In the event of an environmental incident Koppers will submit a Schedule 1 Notice, detailing the nature of the incident and what has been done / will be done to stop the emission, (as outlined in the IPPC Permit No. BV1356IQ) within 24 hours, further details of the incident will be provided by Koppers as soon as practicable.

