URS

Proposal

Plots D,E,F,G Site Investigations

Rhodia, Whitehaven, Cumbria, UK.

Prepared for:

Rhodia UK Limited

Prepared by:

URS Corporation Limited

In association with

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1. INTRODUCTION

1.1. General Information

This proposal presents the objectives, outline scope of works, project schedule, costs and conditions of environmental site investigations in areas identified as Plots D, E, F, and G at the Rhodia UK Ltd. facility in Whitehaven, Cumbria. This proposal has been prepared by URS Corporation Ltd (URS) at the request of Rhodia UK Ltd (Rhodia) during a meeting on 5 February 2007.

1.2. Background Information

Copeland Borough Council (Copeland BC) has identified the site, excluding the Hutbank and Ufex licensed waste disposal areas, as "a special site of contaminated land" in terms of the Environmental Protection Act 1990, Part IIa (as amended) and the Contaminated Land (England) Regulations 2000 (letter of 10 May 2005 from the Copeland BC to the Company Secretary (Rhodia)). Under a separate commission, URS is preparing a Remediation Statement explaining what action is to be taken to address the identified significant pollutant linkages at the site.

URS has undertaken a number of investigations on the Rhodia site, formerly Albright & Wilson, since the mid 1990s. During this period, Rhodia's operations on the site have diminished and associated former operational buildings have been decommissioned. The most recent on-site processes related solely to the surfactants business, which was divested to Huntsman, although it is noted that they have also significantly reduced their site processes in areas where demolition is currently being undertaken. URS has an extensive understanding of the contaminated land issues at the site, developed primarily through the works detailed in our following reports:

- Further Monitoring Works and Risk Assessment Approach for the Environment Agency (report dated 21 January 2005, Issue No 2, 44577-045-787/R1771-B02);
- Additional Investigation at the Former Albright & Wilson Works, Whitehaven (report dated 8 August 2003, reference R1550-C01/44557-033-787/ARC/JMC/pp);
- Refining the Conceptual Site Model at the former Albright & Wilson Facility, Whitehaven (report dated 20 December 2003, reference R1377C/44557-032/787/JRM/pp);
- Source Audit at the Former Albright and Wilson Facility, (report dated 21 March 2002, reference R1131B/44557-026-787/JRM);
- Phase II Soil and Groundwater Investigation (report dated 4 February 2002, reference R1107-C01/44557-021-420/JRM);

- Final Report Environmental Audit Albright & Wilson Whitehaven, England (report dated February 1995;
- Phase II Investigation and Environmental Assessments, Former Albright & Wilson Works, Whitehaven, Cumbria (report dated 23 June 2005, reference 44319623 / R2037);
- Remediation Statement Appendix C; Plot A Soil and Groundwater Investigation. Former Albright and Wilson Works, Whitehaven, Cumbria (report dated 12 January 2007, reference 44320221/MARP0004);
- Remediation Statement Appendix D; Plot B Soil and Groundwater Investigation. Former Albright and Wilson Works, Whitehaven, Cumbria (report dated 12 January 2007, reference 44320221/MARP0003); and,
- Remediation Statement Appendix E; Plot C Soil and Groundwater Investigation. Former Albright and Wilson Works, Whitehaven, Cumbria (report dated 18 September 2006, reference 44319943/MARP0002).

Previous URS Phase II Investigations (ref; 44319623 / R2037) at the site assessed the potential significant pollutant linkages and refined the conceptual site model detailed in Copeland BC's determination. It is noted that this modification has yet to be accepted by the Environment Agency (EA). Areas where further investigation was required in order to fully understand the pollutant linkages were also identified by URS.

1.2.1. Assessment Guidance and Strategy

Various UK guidance documents have been consulted in developing appropriate sampling strategies for the remaining plots. These include various Contaminated Land Research (CLR) Reports such as CLR 4 ("Sampling Strategies for Contaminated Land", published in 1994) and CLR 7 ("Assessment of Risks to Human Health from Land Contamination", published in 2002), the Environment Agency R&D Technical Report P5-066/TR (Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination) and, the British Standard BS10175:2001 (Investigation of potentially contaminated sites – code of practice). It is intended that the proposed investigations are undertaken in compliance with technical guidance so that good practice is followed and that valid and robust data are provided for informing site management decisions or, for assisting in developing scope for potential future supplementary investigation and/or remedial options appraisal and design. The rationale for the sampling densities and analytical suites is presented for Plots D to G in Appendix 1 to 4 respectively. In addition, the scope of works for the investigations required for completion of assessment actions for Plots A and C are also included in Appendices 6 and 7. The rationale for these investigations is presented in the previous reports for these areas as listed in the previous section of this proposal.

2. PROJECT OBJECTIVES

The proposed scope of works will draw on data collected and analysed from previous studies and will supplement it, through collection of new data and analysis specifically orientated to enable appropriate Remediation Actions to be developed and costed. The key objectives of the proposed investigations are as follows:

- To assess further the likely extent and significance of contamination in shallow soil and groundwater identified during the previous assessments in the specified area of interest;
- To provide additional data on a number of potential compounds, which have not previously been detected, but which may be present in the area;
- To provide a comprehensive and robust data set to allow conceptualisation and characterisation of the site area as far as possible;
- To revisit existing data and to supplement this with additional information from the proposed investigation;
- To revise and develop the current Conceptual Site Model;
- To review all the data gathered from the assessments undertaken in the area of interest and to review this against the existing controlled waters and human health site specific risk based screening levels (RBSLs); and,
- To provide a preliminary evaluation of the need for, and scope of, potential remedial options (if considered appropriate) together with an estimation of potential remedial methodologies and costs.

3. SCHEDULE AND PROJECT TEAM

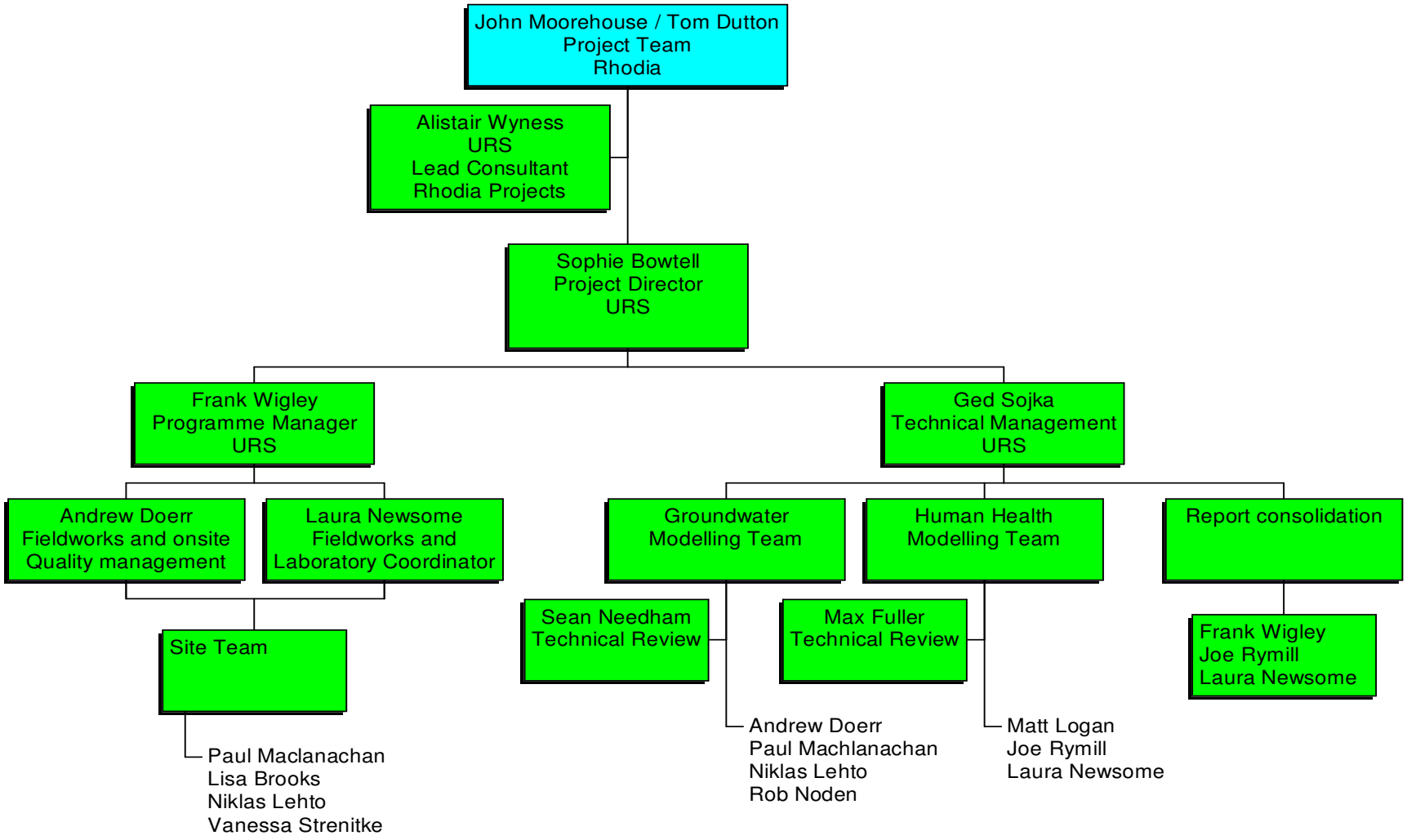
URS understands that Rhodia has a deadline for the receipt of draft reports by 1 May 2007 in order to meet business deadlines. To achieve this, with the production of reports with a robustness that URS considers likely to be required to satisfy the EA, it will be necessary to accelerate the site investigation programme. An outline schedule indicating the anticipated time frame for each task is presented in Figure 1 and an organogram showing the proposed team an their roles is provided in Figure 2 below.

To achieve this, URS proposes to undertake the investigations for each of the investigation plots semi-simultaneously, with the objective of completing the excavation of trial pits and installation of monitoring wells within one working week. Groundwater sampling would be undertaken the following week. To achieve this, it will be necessary to mobilise a greater number of URS field engineers, plant, and facilities to site, resulting in additional cost. Proactive management of the site investigation team (Andrew Doerr) and the scheduling of laboratory samples (Laura Newsome) will also be required to ensure that the quality and direction of the investigation is not compromised. We have also assumed that there will be a senior presence on site (Frank Wigley/ Ged Sojka part time) during the investigation works, to ensure that the investigation is running to plan and the technical standards necessary to meet the EA's requirements are being met.

URS also considers that it will be necessary to accelerate the laboratory analysis to allow sufficient time to undertake the required levels of risk assessment to support the proposed action plans made from the conclusions of the investigations.

On receipt of the laboratory analytical data and the completion of the preliminary conceptual site models for each of the plots, URS proposes to hold an internal meeting for review of each of the investigations and for the senior team members to steer the risk assessment and reporting process which will take place over the remaining month.

Figure 2. Proposed Project Team



4. COSTS

5. TERMS AND CONDITIONS

6. CLOSURE

URS Corporation Ltd would like to thank Rhodia for giving us the opportunity to present this proposal. Should you have any queries or wish to discuss any aspects further, please contact the undersigned. If you wish us to undertake this work for you, we should be grateful if you would provide us with a written instruction. If you wish to authorise only part of the works please indicate in writing which component studies you which URS to complete.

PROPOSAL ACCEPTANCE FORM

Appendix 1

Plot D Site Investigation; Scope of Works

1. APPENDIX 1 PLOT D SITE INVESTIGATION; SCOPE OF WORKS

1.1. Introduction

This appendix presents URS's approach and rationale for the investigation of the Plot D area including the sampling density, suite of laboratory analysis and the number of samples to be tested. Also included in this section is URS's proposals for the analysis of data, risk assessment methodology and reporting format Fieldwork methodologies are considered likely to be the same for the investigations in each of the areas and details of how the fieldworks will be undertaken are described separately in Appendix 7.

1.2. Site Investigation Area - Plot D

For the purpose of focusing the site investigation on the characterisation and delineation of these sources, zoning the area of interest is proposed. The site investigation area is approximately rectangular in shape and is identified as Plot D (Figure 3). The plot area encompasses the lateral dimensions of the identified potential contaminant plumes. The plot lies in the northwest corner of the Rhodia site and comprises part of the former alabaster works, the northwest corner of the fatty alcohol and Ethoxylation plant, and part of the MOS and MO Plants in the southwest corner of the plot. The outfall discharge point for the former Cathedral Smoothing Chamber also lies within Plot D.

1.3. Summary of Approach

The findings from the previous investigations at the Whitehaven site indicated potential significant pollutant linkages from concentrations of naphthalene detected in Plot D, to the Irish Sea controlled waters receptor. Naphthalene was detected in soil samples at concentrations which exceeded the modelled controlled waters Tier 3 criteria. However, due to no detectable concentrations of naphthalene being reported in groundwater it was considered plausible that the partitioning of soil contamination to water may have been an overly conservative estimate of potential risk. Access constraints during the previous investigation works prevented the achievement of an adequate sampling density and additional data will be collected during the proposed works to assist in the characterisation of site wide issues such as the distribution of metal compounds.

1.4. Rationale – Plot D

1.4.1. Sampling Density

There are a total number of 6 existing borehole locations in the area of interest for which there is data available. Two of these were installed as shallow monitoring wells. The estimated area of Plot D is 1.52 hectares. It is considered reasonable by URS, based on both technical guidance and professional judgement, that an additional 19 intrusive sampling locations should be adequate to provide sufficient data in support of future site

assessment management decisions (providing a sampling grid of 24.6 meters. The additional locations would bring the total number of sample points in this area of the site to 41, giving a target sampling density of approximately 27 locations per hectare. The locations will be positioned on an approximate simple grid spaced pattern which will allow delineation of the existing identified contaminants of concern and provide confidence that representative data will be collected on the condition of the plot and for those areas in which there is no data currently available. The provisional sampling locations are indicated on Figure 4, although the exact locations may be moved on site e.g. to avoid underground services or other obstructions.

In addition to the lateral spread of contamination across the plot, the vertical distribution of potential contaminants of concern will be assessed through observations and field measurements during site work and through the collection of samples from a variety of depths. Not only will this assist in the vertical assessment of potential contaminant distribution but also in the conceptualisation of the sub-surface environment and the significance of potential pollutant migration pathways. It is understood from previous investigations in this area of the site that underlying bedrock is located within 5m of ground surface and therefore it is proposed that a maximum depth of 5mbgl will be achieved at each intrusive location or refusal on obstructions/bedrock. It is not proposed to drill monitoring boreholes into the bedrock, because there is already a deep groundwater monitoring programme at the site. This programme is in the process of characterising deep groundwater contamination and further boreholes are not considered necessary.

It should be noted that both lateral and vertical sampling may be dependent upon the underlying ground and geological conditions encountered at the site and that exploratory locations may need to be revised while undertaking intrusive site investigation work. It is known to URS from previous investigations at the site that there are likely to be underground features such as building foundations and concrete slabs which may inhibit or prevent the advancement of exploratory locations. As such, it is considered that the intrusive work will initially commence with exploration using a mechanical backhoe excavator which, it is anticipated, will advance through locations of difficulty and allow a detailed visual assessment of subsurface conditions for the investigation. Following this, it is considered possible that key areas of potential concern may be identified and targeted for further investigation.

It is proposed that a total number of 16 trial pits will be excavated and a further 3 soil borings will be drilled which will be installed with a groundwater monitoring well. It is considered that these locations will allow assessment of the vertical and lateral distribution of potential contamination and soil and groundwater conditions beneath the area of interest.

1.4.2. Laboratory Analytical Schedule

The previous investigations undertaken have identified concentrations of napthalene in soil which exceed thresholds modelled under a Stage 3 detailed quantitative risk

assessment. In addition, the Plot D area has historically been used for the Alabaster, Fatty Alcohol Ethoxylation, and MOS and MO Plants.

URS' understanding of the potential contaminants of concern associated with the former processes and with materials from the former Croft/Ladysmith Pit and Coke works which may have been deposited in this area are summarised below:

- *Alabaster Works*: Heavy Metals, petroleum hydrocarbons, Phosphates and Sulphates;
- *Fatty Alcohol and Ethoxylation Plant*: Surfactants, VOCs, SVOCs, Heavy Metals, Phosphates, Sulphates, Petroleum Hydrocarbons and nitrates;
- *MO and MOS Plants*: Surfactants, Heavy Metals, Phosphates, Sulphates, Petroleum Hydrocarbons and nitrates;
- *Made Ground and Materials imported from Processes elsewhere on Site*: VOCs (though the likelihood is considered to be small) SVOCs (particularly PAHs derived from the Ladysmith Coking works, as demonstrated by their identification during previous investigations), heavy metals, petroleum hydrocarbons, Ammonium, nitrates, cyanide and sulphates.

In addition to the contaminants listed above, the analytical suite will also include contaminants on which Copeland BC determined the site[1] and the additional analytes in groundwater samples which the EA requested during the investigation of both Plots A and B[2].

The primary aim of this investigation is to undertake an investigation to assess the potential to impact a controlled waters receptor, given the risks identified during previous investigation works, and the basis on which the site was classified by Copeland BC. It is therefore proposed that while sufficient soil samples will be submitted for soil analysis to undertaken human health risk assessment and provide background to the underlying soil quality, the bulk of soil samples will be submitted for preparation of NRA Leachates and subsequent analysis of the contaminants of concern[3] URS considers that actual leachate data will enable a more accurate assessment to be carried out: calculations using soils data can give an overly conservative result and result in false positives. By scheduling the leachate tests at the time of the investigation, this data will be available in enough time to include in assessment works. The investigation we have designed considers the

[1] Petroleum Hydrocarbons, Poly Aromatic Hydrocarbons, Surfactants, Phosphates, Heavy Metals (Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc), Volaile Organic Compounds (VOCs), and Semi Volatile Organic Compounds (SVOCs).

[2] Chloride, "Major Ions" (Sulphate, Phosphate, Cyanide, Ammonium, Nitrate) and Field measured parameters including electrical conductivity, pH, redox potential, dissolved oxygen and temperature.

[3] Leachate samples will not be submitted for VOC analysis.

relative analytical costs and benefits associated with this course of action and it in our view the most cost effective means to obtain the data required for the risk assessment.

The table below provides an indication of the collective analytical schedule for the proposed URS investigation. A maximum number of two soil samples will be analysed at each sampling location. For shallow groundwater sampling, it has been assumed that each of the 3 new wells will be sampled. Minor changes to the analytical suite may be made based on the professional judgement of the URS field engineers during the investigation in response to changes in, or unexpected ground conditions

Proposed Analytical Schedule

Analyte	Proposed Analytical Schedule		
	Soil	Shallow Groundwater	Leachate
Surfactants (MBAS)	-	6*	38
Heavy Metals	10	6*	19
Total Cyanide	10	3	19
Ortho Phosphate	15	6*	30
Total Phosphate	15	6*	30
Sulphate	15	3	13
pH	15	3*	38
TPH CWG	10	6*	15
TPH (aliphatic/ aromatic split)	10	-	15
VOCs	25	6*	-
SVOCs	20	6*	30
PCBs	12	-	-
TOC	2	-	-
PSD	2	-	-
Ammonium	15	3	-
Nitrate	15	3	-
Chloride	-	3	-
Total Organic Nitrogen	15	3	-

Note
* include QA / QC analysis

It is proposed to use Alcontrol Geochem of Chester as the laboratory subcontractor for these works. Alcontrol is an MCERTS accredited and URS approved laboratory, who have been commissioned for previous Whitehaven investigations, thus maintaining consistency. Allowance has been made for laboratory analysis to be undertaken on a normal turnaround time basis (usually 10-15 working days). The field measurements, laboratory data and levelling data obtained from the previous and proposed investigations will be collated into a database to allow assessment and reporting to be undertaken. Each new sampling location will be accurately positioned on a scale drawing using the data obtained, together with the locations from the previous investigations within Plot D.

1.4.3. Refining the Conceptual Model

A refined conceptual model will be produced for the site using the additional geological and hydrogeological observations made in the field and the laboratory analysis test results. Once refined, all potentially significant pollutant linkages (source-pathway-receptor relationships) will be reviewed and their plausibility assessed (see below).

1.4.4. Risk Assessment

Based on URS' current understanding, the hydrogeological conditions beneath the Plot D area may be complex due to the nature of the St Bees Evaporites. The conditions may be further complicated by historic site activities, the most prevalent of which has been the deposition of acids into the ground, resulting in voids and channels being created in certain locations, some of which are likely to be in Plot D.

Given the complexity of the geology and the potentially rapid travel times for migration of contamination sourced from Plot D (as found in Plot A which lies adjacent), no standard model (e.g. CONSIM, which was used in Plots B and C) may be appropriate. Instead, a mass balance approach is proposed to be adopted in order to assess potential risks.

1.4.5. Remediation Strategy Development

The central component of the proposed assessment is to develop appropriate remediation actions consistent with the requirements of Part IIA. To achieve this objective, it will be necessary to review all the data available for this area of the site, to refine the conceptual site model and to assess the plausibility of previously identified and potential additional pollutant linkages. It is possible that the additional data may change our conceptual understanding of the pollutant linkages at the site and conclusions and recommendations for future management may have to be reviewed and updated accordingly.

A draft remedial strategy for Plot D suitable for insertion into the Remediation Statement will be prepared. Aspects of Plot D remediation may be dependent on actions to be taken on other areas of the site, and these will be identified. It is envisaged that the remedial strategy will remain in draft until all or most of the Assessment Actions are complete, after which full agreement on the Remediation Actions will be negotiated. This final stage is not included in the scope of this proposal.

The draft remedial strategy will be sufficiently detailed to identify recommended methodology, locations requiring remediation, approximate quantities, timescales, contaminants required to be remediated and standards of remediation proposed. The strategy will not include detailed design, or feasibility trials if such are required.

Outline costs for the draft remedial strategy will be produced, including any additional delineation, detailed design and/or trials considered to be required.

1.4.6. Reporting

Following receipt of the laboratory data and review of the conceptual site model and previous conclusions and recommendations, a report will be presented in the same format and layout as those produced for Plots A and B. The report will have the bulk of the detail in appendices and use the technical detail in each to present justifications for the conceptual site model, its revisions in the light of the controlled waters and human health risk assessments and present proposed actions to address significant source-pathway-receptor linkages identified in the refined CSM. The following information will be included in the appendices:

- Justification of scope of works;
- Field Methodology;
- Borehole and Trial Pit Logs;
- Analytical Schedules, Tabulated Results, Laboratory Certificates, and Historic Data;
- Human Health Detailed Quantitative Risk Assessment;
- Controlled Waters Detailed Quantitative Risk Assessment;
- Model Inputs.

The draft report will be issued to Rhodia in electronic format for review. In addition, a hard copy and an electronic copy will be sent to the Rhodai for review**.** Following receipt one set of consolidated comments, two hard copies and one electronic copy of the final report will be issued to Rhodia within three days of receipt of comments/the meeting. Additional copies for potential third parties can be prepared on request and will incur a cost based on a time and expense basis. The production of the report does not include meetings with Rhodia or the regulatory authorities. Such out of scope meetings would be charged on a Time & Expense basis.

Appendix 2

Plot E Site Investigation; Scope of Works

2. APPENDIX 2 PLOT E SITE INVESTIGATION; SCOPE OF WORKS

2.1. Introduction

This appendix presents URS' approach and rationale for investigation of the Plot E area including the sampling density, the suite of laboratory analysis and the number of samples to be tested. Also included in this section is URS' proposals for the analysis of data, risk assessment methodology and reporting format Fieldwork methodologies are considered likely to be the same for the investigations in each of the areas and details of how these will be undertaken are described separately in Appendix 7.

2.2. Site Investigation Area - Plot E

The site investigation area which is approximately rectangular in shape and lies in the southeast corner of the Rhodia site, comprises areas of ancillary services known to include offices, engineering workshops, research buildings, garages, and a workshop along with an area of former acid storage tanks and drums and the former cement and raffinate works.

2.3. Summary of Approach

Previous investigations at the Whitehaven site have identified potentially significant pollutant linkages from concentrations of a suite of PAHs[4] to human health receptors and TPH in soils and methyl blue activated substances (MBAS) in groundwater in Plot E to the Irish Sea controlled waters receptor. Although TPH was detected in soil samples at concentrations which exceeded the modelled controlled waters Tier 3 criteria, no detectable concentrations of TPH were reported in groundwater and as such, it is considered plausible that the partitioning of soil contamination to water may have been an overly conservative estimate of potential risk. Access constraints during the previous investigation works prevented the achievement of an adequate sampling density and additional data will be collected during the proposed works to assist in the characterisation of site wide issues such as the distribution of metal compounds.

[4] Benzo(a)anthracene, benzo(a)pyrene, benzo(h)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and indeno(1,2,3-cd)pyrene.

2.4. Rationale – Plot E

2.4.1. Sampling Density

There are a total of 6 existing borehole locations in the area of interest for which there is data available. Two of these were installed as shallow monitoring wells. The estimated area of Plot E is 2.8 hectares. It is considered reasonable by URS, based on both technical guidance and professional judgement, that an additional 35 intrusive sampling locations will be adequate in providing sufficient data in support of future site assessment management decisions (providing a sampling grid of 26.8 meters. The additional locations would bring the total number of sample points in this area of the site to 39, giving a target sampling density of approximately 13.9 locations per hectare. The locations will be positioned on an approximate simple grid spaced pattern which will allow delineation of the existing identified contaminants of concern and provide confidence that representative data will be collected on the condition of the plot and for those areas in which there is no data currently available. The provisional sampling locations are indicated on Figure 4, although the exact locations may be moved on site e.g. to avoid underground services or other obstructions.

In addition to the lateral spread of contamination across the plot, the vertical distribution of potential contaminants of concern will be assessed through observations and field measurements during site work and through the collection of samples from a variety of depths. Not only will this assist in the vertical assessment of potential contaminant distribution but also in the conceptualisation of the sub-surface environment and the significance of potential pollutant migration pathways. It is understood from previous investigations in this area of the site that underlying bedrock is located within 5m of ground surface and therefore it is proposed that a maximum depth of 5mbgl will be achieved at each intrusive location or refusal on obstructions/bedrock. It is not proposed to drill monitoring boreholes into the bedrock, because there is already a deep groundwater monitoring programme at the site. This programme is in the process of characterising deep groundwater contamination and further boreholes are not considered necessary.

It should be noted that both lateral and vertical sampling may be dependent upon the underlying ground and geological conditions encountered at the site and that exploratory locations may need to be revised while undertaking intrusive site investigation work. It is known to URS from previous investigations at the site that there are likely to be underground features such as building foundations and concrete slabs which may inhibit or prevent the advancement of exploratory locations. As such, it is considered that the intrusive work will initially commence with exploration using a mechanical backhoe excavator which, it is anticipated, will advance through locations of difficulty and allow a detailed visual assessment of subsurface conditions for the investigation. Following this, it is considered possible that key areas of potential concern may be identified and targeted for further investigation.

It is proposed that a total of 30 trial pits will be excavated and a further 5 soil borings will be drilled which will be installed with a groundwater monitoring well. It is considered that

these locations will allow assessment of the vertical and lateral distribution of potential contamination and soil and groundwater conditions beneath the area of interest.

2.4.2. Laboratory Analytical Schedule

The previous investigations undertaken have identified concentrations of PAHs and TPH in soil, and MBAS in groundwater which exceed thresholds modelled under a Stage 3 detailed quantitative risk assessment. In addition, the Plot E area has historically been used for a variety of purposes including cement production, raffinate treatment, drum storage, research buildings, garages, and acid storage.

URS' understanding of the potential contaminants of concern associated with the former processes and with materials from the former Croft/Ladysmith Pit and Coke works which may have been deposited in this area are summarised below:

- *Cement Works*: Heavy Metals, petroleum hydrocarbons, Phosphates and Sulphates;
- *Raffinate Treatment Plant*: Surfactants, VOCs, SVOCs, Heavy Metals, Phosphates, Sulphates, Petroleum Hydrocarbons and Nitrates;
- *Laboratories*: Surfactants, Heavy Metals, Phosphates, Sulphates, Petroleum Hydrocarbons and Nitrates;
- *Garages*: petroleum hydrocarbons, VOCs and SVOCs;
- *Acid Storage*: Phosphates, sulphates, nitrates, ammonia and heavy metals;
- *Made Ground an Materials imported from Processes elsewhere on Site*: VOCs (though the likelihood is considered to be small) SVOCs (particularly PAHs derived from the Ladysmith Coking works, as demonstrated by their identification during previous investigations), heavy metals, petroleum hydrocarbons, Ammonium, nitrates, cyanide and sulphates.

In addition to the contaminants listed above, the analytical suite will also include contaminants on which Copeland BC determined the site[5] and the additional analytes in groundwater samples which the EA requested during the investigation of both Plots A and B[6].

[5] Petroleum Hydrocarbons, Poly Aromatic Hydrocarbons, Surfactants, Phosphates, Heavy Metals (Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc), Volaile Organic Compounds (VOCs), and Semi Volatile Organic Compounds (SVOCs).

[6] Chloride, "Major Ions" (Sulphate, Phosphate, Cyanide, Ammonium, Nitrate) and Field measured parameters including electrical conductivity, pH, redox potential, dissolved oxygen and temperature.

The primary aim of this investigation is to undertake an investigation to assess both the potential to impact a controlled waters receptor and a human health receptor, given the risks identified during previous investigation works, and the basis on which the site was classified by Copeland BC. It is therefore proposed that while sufficient soil samples will be submitted for soil analysis to undertaken human health risk assessment and provide background to the underlying soil quality, the bulk of soil samples will be submitted for preparation of NRA Leachates and subsequent analysis of the contaminants of concern[7] URS considers that actual leachate data will enable a more accurate assessment to be carried out: calculations of k_Ds using soils data can give an overly conservative result and result in false positives. By scheduling the leachate tests at the time of the investigation, this data will be available in enough time to include in assessment works. The investigation we have designed considers the relative analytical costs and benefits associated with this course of action and it in our view the most cost effective means to obtain the data required for the risk assessment.

The table below provides an indication of the collective analytical schedule for the proposed URS investigation. A maximum number of two soil samples will be analysed at each sampling location. For shallow groundwater sampling, it has been assumed that each of the 5 new wells will be sampled. Minor changes to the analytical suite may be made based on the professional judgement of the URS field engineers during the investigation in response to changes in, or unexpected ground conditions

Proposed Analytical Schedule

Analyte	Proposed Analytical Schedule		
	Soil	Shallow Groundwater	Leachate
Surfactants (MBAS)		8*	45
Heavy Metals	20	8*	35
Total Cyanide	20	5	35
Ortho Phosphate	20	8*	45
Total Phosphate	20	8*	45
Sulphate	20	5	45
pH	20	5	45
TPH CWG	20	8*	45
TPH (aliphatic/ aromatic split)	10	-	-
VOCs	35	8*	-
SVOCs	40	6*	35
PCBs	5	-	-
TOC	2	-	-
PSD	2	-	-
Ammonium	20	5	-
Nitrate	20	5	-
Chloride	-	5	-
Total Organic Nitrogen	20	5	35

Note * include QA / QC analysis

[7] Leachate samples will not be submitted for VOC analysis.

It is proposed to use Alcontrol Geochem of Chester as the laboratory subcontractor for these works. Alcontrol is an MCERTS accredited and URS approved laboratory, who have been commissioned for previous Whitehaven investigations, thus maintaining consistency. Allowance has been made for laboratory analysis to be undertaken on a normal turnaround time basis (usually 10-15 working days). The field measurements, laboratory data and levelling data obtained from the previous and proposed investigations will be collated into a database to allow assessment and reporting to be undertaken. Each new sampling location will be accurately positioned on a scale drawing using the data obtained, together with the locations from the previous investigations within Plot E.

2.4.3. Refining the Conceptual Model

A refined conceptual model will be produced using the additional geological and hydrogeological observations made in the field and the laboratory analysis test results. Once refined, all significant pollutant linkages (source-pathway-receptor relationships) will be reviewed and their plausibility assessed (see below).

2.4.4. Risk Assessment

A human health assessment will be made based on the condition of the subsurface soil and groundwater beneath Plot F for an end use of open access land. This will be completed in two stages, firstly a conservative generic quantitative screening assessment followed if necessary by a stage 3 assessment using the URS in-house model, Human7, which is based on the algorithms detailed in CLR10.

Based on URS' current understanding, the hydrogeological conditions beneath the Plot D area may be complex due to the nature of the St Bees Evaporites. The conditions may be further complicated by historic site activities, the most prevalent of which has been the deposition of acids into the ground, resulting in voids and channels being created in certain locations, some of which are likely to be in Plot E.

Given the complexity of the geology and the potentially rapid travel times for migration of contamination sourced from Plot D (as found in Plot A which lies adjacent), no standard model (e.g. CONSIM, which was used in Plots B and C) may be appropriate. Instead, a mass balance approach is proposed to be adopted in order to assess potential risks.

2.4.5. Remediation Strategy Development

The central component of the proposed assessment is to develop appropriate remediation actions consistent with the requirements of Part IIA. In order to achieve this objective, it will be necessary to review all the data available for this area of the site, to refine the conceptual site model and to assess the plausibility of previously identified and potential additional pollutant linkages. It is possible that the additional data may change our conceptual understanding of the pollutant linkages at the site and therefore conclusions and recommendations for future management may have to be reviewed and updated accordingly.

A draft remedial strategy for Plot E suitable for insertion into the Remediation Statement will be prepared. Aspects of Plot E remediation may be dependent on actions to be taken on other areas of the site, and these will be identified. It is envisaged that the remedial strategy will remain in draft until all or most of the Assessment Actions are complete, after which full agreement on the Remediation Actions will be negotiated. This final stage is not included in the scope of this proposal.

The draft remedial strategy will be sufficiently detailed to identify recommended methodology, locations requiring remediation, approximate quantities, timescales, contaminants required to be remediated and standards of remediation proposed. The strategy will not include detailed design, or feasibility trials if such are required.

Outline costs for the draft remedial strategy will be produced, including any additional delineation, detailed design and/or trials.

2.4.6. Reporting

Following receipt of the laboratory data and the review of the conceptual site model and previous conclusions and recommendations, a report will be presented in the same format and layout as those produced for Plots A and B. The report will have the bulk of the detail in appendices and use the technical detail in each to present to justifications for the conceptual site model, its revisions in the light of the controlled waters and human health risk assessments and present proposed actions to address significant source-pathway-receptor linkages identified in the refined CSM. In addition to the main report the following information will be included in appendices:

- Justification of scope of works;
- Field Methodology;
- Borehole and Trial Pit Logs;
- Analytical Schedules, Tabulated Results, Laboratory Certificates, and Historic Data;
- Human Health Detailed Quantitative Risk Assessment;
- Controlled Waters Detailed Quantitative Risk Assessment; and,
- Model Inputs.

The draft report will be issued to Rhodia in electronic format for review. Following receipt of one set of consolidated comments, two hard copies and one electronic copy of the final report will be issued to Rhodia within three days of receipt of comments/the meeting. Additional copies for potential third parties can be prepared on request and will incur a cost based on a time and expense basis. The production of the report does not include meetings with Rhodia or the authorities. Such out of scope meetings would be charged on a Time & Expense basis.

Appendix 3

Plot F Site Investigation; Scope of Works

3. APPENDIX 3 PLOT F SITE INVESTIGATION; SCOPE OF WORKS

3.1. Introduction

This appendix presents URS' approach and rationale for investigation of the Plot F area including the sampling density, the suite of laboratory analysis and the number of samples to be tested. Also included in this section is URS' proposals for the analysis of data, risk assessment methodology and reporting format Fieldwork methodologies are considered likely to be the same for the investigations in each of the areas and details of how these will be undertaken are described separately in Appendix 7.

3.2. Site Investigation Area - Plot F

The site investigation area is approximately rectangular in shape and is identified as Plot F (Figure 3). The plot area encompasses the lateral dimensions of the mercury contamination identified during the Phase II Site investigation, lies in the northeast corner of the Rhodia site and includes an area formerly occupied by the dye and perfume shed and more recently by an above ground storage tank farm reported to have been used for the storage of fuel oils. The Plot F area lies to the East of the former Huntsman production facilities.

3.3. Summary of Approach

Previous investigations at the Whitehaven site have identified potentially significant pollutant linkages from concentrations of mercury which exceeded the modelled human health detailed quantitative risk assessment. It was concluded in the Phase II assessment that the mercury was most likely to be a hotspot, but that additional investigation should be undertaken in order to determine whether a risk to human health exists. In addition, it is proposed that additional sampling should be undertaken to assess the potential for the presence of petroleum hydrocarbons from the tank farm as well as surfactants and process chemicals which may be derived from the former Huntsman works.

3.4. Rationale – Plot F

3.4.1. Sampling Density

There are a total number of 3 existing borehole locations in the area of interest for which there is data available. Two of these were installed as shallow monitoring wells. In addition there is a further monitoring well (SB6) located less than 5 m from the western boundary of Plot F. The estimated area of Plot F is 0.22 hectares. It is considered

reasonable by URS, based on both technical guidance and professional judgement, that an additional 6 intrusive sampling locations will be adequate to provide sufficient data in support of future site assessment management decisions (providing a sampling grid of 14.8 meters. The additional locations would bring the total number of sample points in this area of the site to 10, giving a target sampling density of approximately 45.5 locations per hectare. The locations will be positioned on an approximate grid spaced pattern which will allow delineation of the existing identified contaminants of concern and provide confidence that representative data will be collected on the condition of the plot and for those areas in which there is no data currently available. The provisional sampling locations are indicated on Figure 4, although the exact locations may be moved on site e.g. to avoid underground services or other obstructions. In addition, where multiple samples are collected from trial pits, the length of the trial pit (anticipated to be up to 4 m) will be used to separate the samples providing greater coverage.

In addition to the lateral spread of contamination across the plot, the vertical distribution of potential contaminants of concern will be assessed through observations and field measurements during site work and through the collection of samples from a variety of depths. This will not only assist in the assessment of potential vertical contaminant distribution but also in the conceptualisation of the sub-surface environment and the significance of potential pollutant migration pathways. It is understood from previous investigations in this area of the site that underlying bedrock is located within 5m of ground surface and therefore it is proposed that a maximum depth of 5mbgl will be achieved at each intrusive location or refusal on obstructions/bedrock. Given that there is already a deep groundwater monitoring programme at the site, no drilling is proposed in bedrock. This programme is in the process of characterising deep groundwater contamination and further boreholes are not necessary.

It should be noted that both lateral and vertical sampling may be dependent upon the underlying ground and geological conditions encountered at the site and that exploratory locations may need to be revised while undertaking intrusive site investigation work. It is known to URS from previous investigations at the site that there are likely to be underground features such as building foundations and concrete slabs, which may inhibit or prevent the advancement of exploratory locations. As such, it is considered that the intrusive work will initially commence with exploration using a mechanical backhoe excavator which, it is anticipated, will advance through locations of difficulty and allow a detailed visual assessment of subsurface conditions for the investigation. Following this, it is considered possible that key areas of potential concern may be identified and targeted for further investigation.

A total number of 6 trial pits will be excavated but it is considered likely that further soil borings will not be necessary.

3.4.2. Laboratory Analytical Schedule

Previous investigations undertaken have identified concentrations of mercury in soil which exceed thresholds modelled under a stage 3 Human Health detailed quantitative risk

assessment. In addition, there has historically been use of dyes and the storage of fuel oils within the Plot F area along with the presence of the Huntsman surfactant manufacturing activities adjacent to the east. There is also the potential for materials from the former Croft/Ladysmith Pit and Coke works to have been deposited in this area. The contaminants considered to be potentially present are summarised below:

- *Former Heavy Oil ASTs*: Petroleum hydrocarbons, SVOCs and VOCs;
- *Former Huntsman Operations Plant*: Surfactants, VOCs, SVOCs, Heavy Metals, Phosphates, Sulphates, Petroleum Hydrocarbons, nitrates and Ammonia;
- *Identified Mercury contamination*: Mercury;
- *Made Ground an Materials imported from Processes elsewhere on Site*: VOCs (though the likelihood is considered to be small) SVOCs (particularly PAHs derived from the Ladysmith Coking works, as demonstrated by their identification during previous investigations, heavy metals, petroleum hydrocarbons, Ammonium, nitrates, cyanide and sulphates.

In addition to the contaminants of concern listed above, the analytical suite will also include the contaminants on which Copeland BC determined the site[8] and additional analytes in groundwater samples, which the Environment Agency requested during the investigation of both Plots A and B[9].

The primary aim of this investigation is to assess the potential to impact on human health receptors, given the risks identified in the Phase II investigation. Sufficient soil samples will be submitted for soil analysis to undertake the assessment required and provide background to the underlying soil quality. An additional number of soil samples will be submitted for preparation of NRA Leachates and subsequent analysis of the contaminants of concern[10] The proportion of samples submitted for leachate analysis will be comparatively less that for other Plots, where the driver for further investigation is risk to controlled waters.

The investigation we have designed considers the relative analytical costs and benefits and is in our view the most cost effective means to obtain the data required for the risk assessment.

[8] Petroleum Hydrocarbons, Poly Aromatic Hydrocarbons, Surfactants, Phosphates, Heavy Metals (Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc), Volaile Organic Compounds (VOCs), and Semi Volatile Organic Compounds (SVOCs).

[9] Chloride, “Major Ions” (Sulphate, Phosphate, Cyanide, Ammonium, Nitrate) and Field measured parameters including electrical conductivity, pH, redox potential, dissolved oxygen and temperature.

[10] Leachate samples will not be submitted for VOC analysis.

The table below provides an indication of the collective analytical schedule for the proposed URS investigation. A maximum number of two soil samples will be analysed at each sampling location. For shallow groundwater sampling, it has been assumed that each of the existing wells and SB6 located just outside Plot F wells will be sampled. However, minor changes to the analytical suite may be made based on the professional judgement of the URS field engineers during the investigation in response to changes in, or unexpected ground conditions

Proposed Analytical Schedule

Analyte	Proposed Analytical Schedule		
	Soil	Shallow Groundwater	Leachate
Surfactants (MBAS)	6	6*	3
Heavy Metals	12	6*	6
Total Cyanide	6	3	3
Ortho Phosphate	6	6*	3
Total Phosphate	6	6*	3
Sulphate	6	3	3
pH	6	3*	3
TPH CWG	9	6*	-
TPH (aliphatic/ aromatic split)	6	-	3
VOCs	8	6*	-
SVOCs	6	6*	3
PCBs	2	-	-
TOC	2	-	-
PSD	2	-	-
Ammonium	6	3	-
Nitrate	6	3	-
Chloride	-	3	-
Total Organic Nitrogen	6	3	-

Note
* include QA / QC analysis

It is proposed to use Alcontrol Geochem of Chester as the laboratory subcontractor for these works. Alcontrol is an MCERTS accredited and URS approved laboratory, who have been commissioned for previous Whitehaven investigations, thus maintaining consistency. Allowance has been made for laboratory analysis to be undertaken on a normal turnaround time basis (usually 10-15 working days). The field measurements, laboratory data and levelling data obtained from the previous and proposed investigations will be collated into a database to allow assessment and reporting to be undertaken. Each new sampling location will be accurately positioned on a scale drawing using the data obtained, together with the locations from the previous investigations within Plot F.

3.4.3. Refining the Conceptual Model

A refined conceptual model will be produced using the additional geological and hydrogeological observations made in the field and the laboratory analysis test results. Once refined, all significant pollutant linkages (source-pathway-receptor relationships) will be reviewed and their plausibility assessed (see below).

3.4.4. Risk Assessment

A human health assessment will be made based on the condition of the subsurface soil and groundwater beneath Plot F for an end use of open access land. This will be completed in two stages, firstly a conservative generic quantitative screening assessment followed if necessary by a stage 3 assessment using the URS in-house model, Human7, which is based on the algorithms detailed in CLR10.

Based on URS' current understanding, the hydrogeological conditions beneath the Plot F area may be complex due to the nature of the St Bees Evaporites. The conditions may be further complicated by historic site activities, the most prevalent of which has been the deposition of acids into the ground, resulting in voids and channels being created in certain locations, some of which are likely to be in Plot F.

Given the complexity of the geology and the potentially rapid travel times for migration of contamination sourced from Plot F (as found in Plot A which lies adjacent), no standard model (e.g. CONSIM, which was used in Plots B and C) may be appropriate. Instead, a mass balance approach is proposed to be adopted in order to assess potential risks.

3.4.5. Remediation Strategy Development

The central component of the proposed assessment is to develop appropriate remediation actions consistent with the requirements of Part IIA. In order to achieve this objective, it will be necessary to review all the data available for this area of the site, to refine the conceptual site model and to assess the plausibility of previously identified and potential additional pollutant linkages. It is possible that the additional data may change our conceptual understanding of the pollutant linkages at the site and therefore conclusions and recommendations for future management may have to be reviewed and updated accordingly.

A draft remedial strategy for Plot F suitable for insertion into the Remediation Statement will be prepared. Aspects of Plot F remediation may be dependent on actions to be taken on other areas of the site, and these will be identified. It is envisaged that the remedial strategy will remain in draft until all or most of the Assessment Actions are complete, after which full agreement on the Remediation Actions will be negotiated. This final stage is not included in the scope of this proposal.

The draft remedial strategy will be sufficiently detailed to identify recommended methodology, locations requiring remediation, approximate quantities, timescales, contaminants required to be remediated and standards of remediation proposed. The strategy will not include detailed design, or feasibility trials if such are required.

Outline costs for the draft remedial strategy will be produced, including any additional delineation, detailed design and/or trials.

3.4.6. Reporting

Following receipt of the laboratory data and the review of the conceptual site model and previous conclusions and recommendations, a report will be presented in the same format and layout as those produced for Plots A and B. The report will have the bulk of the detail in appendices and use the technical detail in each to present to justifications for the conceptual site model, its revisions in the light of the controlled waters and human health risk assessments and present proposed actions to address significant source-pathway-receptor linkages identified in the refined CSM. In addition to the main report the following information will be included in the appendices:

- Justification of scope of works;
- Field Methodology;
- Borehole and Trial Pit Logs;
- Analytical Schedules, Tabulated Results, Laboratory Certificates, and Historic Data;
- Human Health Detailed Quantitative Risk Assessment;
- Controlled Waters Detailed Quantitative Risk Assessment; and,
- Model Inputs.

The draft report will be issued to Rhodia in electronic format for review. Following receipt of one set of consolidated comments, two hard copies and one electronic copy of the final report will be issued to Rhodia within three days of receipt of comments/the meeting. Additional copies for potential third parties can be prepared on request and will incur a cost based on a time and expense basis. The production of the report does not include meetings with Rhodia or the authorities. Such out of scope meetings would be charged on a Time & Expense basis.

Appendix 4

Plot G Site Investigation; Scope of Works

4. APPENDIX 4 PLOT G SITE INVESTIGATION; SCOPE OF WORKS

4.1. Introduction

This appendix presents URS' approach and rationale for investigation of the Plot G area including the sampling density, the suite of laboratory analysis and the number of samples to be tested. Also included in this section is URS' proposals for the analysis of data, risk assessment methodology and reporting format Fieldwork methodologies are considered likely to be the same for the investigations in each of the areas and details of how these will be undertaken are described separately in Appendix 7.

4.2. Site Investigation Area - Plot G

For the purpose of focusing the site investigation on the characterisation and delineation of these sources, zoning the area of interest is proposed. The site investigation area is approximately rectangular in shape and is identified as Plot G (Figure 3). The plot area encompasses the lateral dimensions of the identified potential napthalene and TPH contaminant plumes, lies to the west of centre of the of the Rhodia site and includes the former fire water basin, the treatment basin a former tank farm and the site of two former cooling towers.

4.3. Summary of Approach

Previous investigations at the Whitehaven site have identified potentially significant pollutant linkages from concentrations of naphthalene and petroleum hydrocarbons detected in Plot G to the Irish Sea controlled waters receptor. Both naphthalene and total petroleum hydrocarbons (TPH) were detected in soil samples at concentrations which exceeded the modelled controlled waters Tier 3 criteria. No detectable concentrations of naphthalene or TPH were reported in groundwater however and it is considered plausible that the partitioning of soil contamination to water may have been an overly conservative estimate of potential risk. Access constraints during the previous investigation works prevented the achievement of an adequate sampling density and additional data will be collected during the proposed works to assist in the characterisation of site wide issues such as the distribution of metal compounds.

4.4. Rationale – Plot G

4.4.1. Sampling Density

There are a total of 6 existing borehole locations in the area of interest for which there is data available. A total of 3 of these were installed as shallow monitoring wells. The estimated area of Plot G is 0.62 hectares. It is considered reasonable by URS, based on both technical guidance and professional judgement, that an additional 11 intrusive sampling locations will be adequate in providing sufficient data in support of future site

assessment management decisions (providing a sampling grid of 19.1 meters. The additional locations would bring the total number of sample points in this area of the site to 17, giving a target sampling density of approximately 27.4 locations per hectare. The locations will be positioned on an approximate simple grid spaced pattern which may allow delineation of the existing identified contaminants of concern and provide confidence that data representative of the condition of the plot and for those areas in which there is no data currently available is collected. The provisional sampling locations are indicated on Figure 6, although the exact locations may be moved on site e.g. to avoid underground services or other obstructions.

In addition to the lateral spread of contamination across the plot, the vertical distribution of potential contaminants of concern will be assessed through observations and field measurements during site work and through the collection of samples from a variety of depths. This will not only assist in the assessment of potential vertical contaminant distribution but also in the conceptualisation of the sub-surface environment and the significance of potential pollutant migration pathways. It is understood from previous investigations in this area of the site that underlying bedrock is located within 5m of ground surface and therefore it is proposed that a maximum depth of 5mbgl will be achieved at each intrusive location or refusal on obstructions/bedrock. Given that there is already a deep groundwater monitoring programme at the site, no drilling is proposed in bedrock. This programme is in the process of characterising deep groundwater contamination and further boreholes are not necessary.

It should be noted that both lateral and vertical sampling may be dependent upon the underlying ground and geological conditions encountered at the site and that exploratory locations may need to be revised while undertaking intrusive site investigation work. It is known to URS from previous investigations at the site that there are likely to be underground features such as building foundations and concrete slabs, which may inhibit or prevent the advancement of exploratory locations. As such, it is considered that the intrusive work will initially commence with exploration using a mechanical backhoe excavator which, it is anticipated, will advance through locations of difficulty and allow a detailed visual assessment of subsurface conditions for the investigation. Following this, it is considered possible that key areas of potential concern may be identified and targeted for further investigation.

It is proposed that a total number of 8 trial pits will be excavated and a further 3 soil borings will be drilled which will be installed with a groundwater monitoring well. It is considered that these locations will allow assessment of the vertical and lateral distribution of potential contamination and soil and groundwater conditions beneath the area of interest.

4.4.2. Laboratory Analytical Schedule

The previous investigations undertaken have identified concentrations of napthalene and TPH in soil which exceed thresholds modelled under a Stage 3 detailed quantitative risk assessment. In addition, part of the Plot G area has historically been used for the Fatty

Alcohol Ethoxylation Plant and the remainder used for ancillary services. URS also consider it likely that fill materials derived from operations, construction, demolition or activities elsewhere on site may be present beneath the area. There is also the potential for materials from the former Croft/Ladysmith Pit and Coke works to have been deposited in this area. The contaminants considered to be potentially present are summarised below:

- *Fatty Alcohol and Ethoxylation Plant*: Surfactants, VOCs, SVOCs, Heavy Metals, Phosphates, Sulphates, Petroleum Hydrocarbons and Nitrates;
- *Made Ground an Materials imported from Processes elsewhere on Site*: VOCs (though the likelihood is considered to be small) SVOCs (particularly PAHs derived from the Ladysmith Coking works, as demonstrated by their identification during previous investigations, heavy metals, petroleum hydrocarbons, Ammonium, nitrates, cyanide and Sulphates.

In addition to the contaminants of concern listed above, the analytical suite will also include contaminants on which Copeland BC determined the site[11] and also the additional analytes in groundwater samples, which the EA requested during the investigation of both Plots A and B[12].

The primary aim of this investigation is to assess the potential to impact a controlled waters receptor, given that the risks identified in the previous investigation, and the basis on which the site was classified by Copeland Borough Council. It is therefore that while sufficient soil samples will be submitted for soil analysis to undertaken human health risk assessment and provide background to the underlying soil quality, the bulk of soil samples will be submitted for preparation of NRA Leachates and subsequent analysis of the contaminants of concern[13]. URS considers that actual leachate data will enable a more accurate assessment to be carried out: calculations of k_Ds using soils data can give an overly conservative result and result in false positives. By scheduling the leachate tests at the time of the investigation, this data will be available in enough time to include in assessment works. The investigation we have designed considers the relative analytical costs and benefits and is in our view the most cost effective means to obtain the data required for the risk assessment.

The table below provides an indication of the collective analytical schedule for the proposed URS investigation. A maximum number of two soil samples will be analysed at each sampling location. For shallow groundwater sampling, it has been assumed that

[11] Petroleum Hydrocarbons, Poly Aromatic Hydrocarbons, Surfactants, Phosphates, Heavy Metals (Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc), Volaile Organic Compounds (VOCs), and Semi Volatile Organic Compounds (SVOCs).

[12] Chloride, “Major Ions” (Sulphate, Phosphate, Cyanide, Ammonium, Nitrate) and Field measured parameters including electrical conductivity, pH, redox potential, dissolved oxygen and temperature.

[13] Leachate samples will not be submitted for VOC analysis.

each of the 3 new wells will be sampled. However, minor changes to the analytical suite may be made based on the professional judgement of the URS field engineers during the investigation in response to changes in, or unexpected ground conditions

Proposed Analytical Schedule

Analyte	Proposed Analytical Schedule		
	Soil	Shallow Groundwater	Leachate
Surfactants (MBAS)	-	8*	22
Heavy Metals	8	8*	16
Total Cyanide	8	3	16
Ortho Phosphate	8	8*	16
Total Phosphate	8	8*	30
Sulphate	8	3	11
pH	8	8*	22
TPH CWG	-	8*	11
TPH (aliphatic/ aromatic split)	8	-	11
VOCs	8	8*	-
SVOCs	11	8*	16
PCBs	2	-	-
TOC	2	-	-
PSD	2	-	-
Ammonium	8	3	-
Nitrate	8	3	-
Chloride	-	3	-
Total Organic Nitrogen	8	3	-

Note
* include QA / QC analysis

It is proposed to use Alcontrol Geochem of Chester as the laboratory subcontractor for these works. Alcontrol is an MCERTS accredited and URS approved laboratory, who have been commissioned for previous Whitehaven investigations, thus maintaining consistency. Allowance has been made for laboratory analysis to be undertaken on a normal turnaround time basis (usually 10-15 working days). The field measurements, laboratory data and levelling data obtained from the previous and proposed investigations will be collated into a database to allow assessment and reporting to be undertaken. Each new sampling location will be accurately positioned on a scale drawing using the data obtained, together with the locations from the previous investigations within Plot G.

4.4.3. Refining the Conceptual Model

A refined conceptual model will be produced using the additional geological and hydrogeological observations made in the field and the laboratory analysis test results. Once refined, all significant pollutant linkages (source-pathway-receptor relationships) will be reviewed and their plausibility assessed (see below).

4.4.4. Risk Assessment

Based on URS' current understanding, the hydrogeological conditions beneath the Plot F area may be complex due to the nature of the St Bees Evaporites. The conditions may be further complicated by historic site activities, the most prevalent of which has been the deposition of acids into the ground, resulting in voids and channels being created in certain locations, some of which are likely to be in Plot F.

Given the complexity of the geology and the potentially rapid travel times for migration of contamination sourced from Plot F (as found in Plot A which lies adjacent), no standard model (e.g. CONSIM, which was used in Plots B and C) may be appropriate. Instead, a mass balance approach is proposed to be adopted in order to assess potential risks.

4.4.5. Remediation Strategy Development

The central component of the proposed assessment is to develop appropriate remediation actions consistent with the requirements of Part IIA. To achieve this objective, it will be necessary to review all the data available for this area of the site, to refine the conceptual site model and to assess the plausibility of previously identified and potential additional pollutant linkages. It is possible that the additional data may change our conceptual understanding of the pollutant linkages at the site and therefore conclusions and recommendations for future management will have to be reviewed and updated accordingly.

A draft remedial strategy for Plot G suitable for insertion into the Remediation Statement will be prepared. Aspects of Plot G remediation may be dependent on actions to be taken on other areas of the site, and these will be identified. It is envisaged that the remedial strategy will remain in draft until all or most of the Assessment Actions are complete, after which full agreement on the Remediation Actions will be negotiated. This final stage is not included in the scope of this proposal.

The draft remedial strategy will be sufficiently detailed to identify recommended methodology, locations requiring remediation, approximate quantities, timescales, contaminants required to be remediated and standards of remediation proposed. The strategy will not include detailed design, or feasibility trials if such are required.

Outline costs for the draft remedial strategy will be produced, including any additional delineation, detailed design and/or trials.

4.4.6. Reporting

Following receipt of the laboratory data and the review of the conceptual site model and previous conclusions and recommendations, a report will be presented in the same format and layout as those produced for Plots A and B. The report will have the bulk of the detail in appendices and use the technical detail in each to present to justifications for the conceptual site model, its revisions in the light of the controlled waters and human health risk assessments and present proposed actions to address significant source-pathway-

receptor linkages identified in the refined CSM. The following information will be included in the appendices:

- Justification of scope of works;
- Field Methodology;
- Borehole and Trial Pit Logs;
- Analytical Schedules, Tabulated Results, Laboratory Certificates, and Historic Data;
- Human Health Detailed Quantitative Risk Assessment;
- Controlled Waters Detailed Quantitative Risk Assessment;
- Model Inputs.

The draft report will be issued to Rhodia in electronic format for review. Following receipt one set of consolidated comments, two hard copies and one electronic copy of the final report will be issued to Rhodia within three days of receipt of comments/the meeting. Additional copies for potential third parties can be prepared on request and will incur a cost based on a time and expense basis. The production of the report does not include meetings with Rhodia or the authorities. Such out of scope meetings would be charged on a Time & Expense basis.

Appendix 5

Plot A Further Actions; Scope of Works

5. PLOT A FURTHER ACTIONS - SCOPE OF WORKS

The rationale for the scope of works for Plot A is defined in the previous investigation[14] and is summarised below.

The majority of potential pollutant linkages have been shown to be not significant, and therefore no remediation actions will be necessary. Some potential linkages have been identified however which will require additional investigation in order to assess their significance.

The results of the modelling have indicated that potentially significant risks may be present with regard to controlled waters. Three areas of the site comprising an area extending from TP628A to TP630A; the area around TP624A; and the area around WS115 and TP602A will require further invesitgation and assessment to determine whether or not remedial action may be required.

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

Area 1 - The area in the vicinity of TP628A to TP630A

It is proposed that up to 7 trial pits are advanced to 5mbgl (or bedrock, if shallower) and up to 2 groundwater monitoring wells are installed in the vicinity of TP628A to TP630A. Soil samples would be collected at approximate 0.5m intervals for subsequent on site headspace analysis. Up to two samples would be subsequently scheduled for analysis from each location; one shallow sample within the made ground and one deeper sample within the underlying strata, where possible. If a significant presence of contamination is detected, additional samples may be scheduled for analysis. Soil analysis shall include total soil and soil leachate tests for the presence of TPH. Groundwater, where present, shall be scheduled for TPH analysis.

Area 2 - The area in the vicinity of TP624A

It is proposed that up to 4 trial pits are advanced to 5mbgl (or bedrock, if shallower) and 1 groundwater monitoring well is installed in the vicinity of TP624. Soil samples shall be taken at approximate 0.5m intervals for subsequent on site headspace analysis. Up to two samples shall be scheduled for analysis from each location; one shallow sample within the made ground and one deeper sample within the underlying strata, where possible. If a significant presence of contamination is detected, additional samples may be scheduled for analysis. Soil analysis shall include total soil and soil leachate tests for the presence of TPH. Groundwater, where present, shall be scheduled for TPH analysis.

[14] Remediation Statement Appendix C; Plot A Soil and Groundwater Investigation. Former Albright and Wilson Works, Whitehaven, Cumbria. 12 January 2007. ref 44320221/MARP0004.

Area 3 - The area in the vicinity of WS115 and TP602A

It is proposed that up to 3 trial pits are advanced to 5mbgl (or bedrock, if shallower) and up to three groundwater monitoring wells are installed in the vicinity of WS115 and TP602A. Soil samples shall be taken at approximately 0.5m intervals for subsequent on site headspace analysis. Up to two samples shall be scheduled for analysis from each location; one shallow sample within the made ground and one deeper sample within the underlying strata, where possible. If a significant presence of contamination is detected, additional samples may be scheduled for analysis. Soil analysis shall include total soil and soil leachate tests for the presence of PAH's, zinc and cyanide. Groundwater, where present, shall be scheduled for PAHs, zinc and cyanide analysis.

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

Appendix 6

Plot C Further Actions; Scope of Works

6. PLOT C: SCOPE OF WORKS ADDITIONAL SAMPLING AROUND A111

It is proposed that up to 18 soil samples are collected from 6 locations in the area of A111 at approximate depths of 0.05m, 0.5m and 1.0m below ground level and submitted to the laboratory for arsenic analysis. The concentrations reported would then be screened against the site-specific assessment criteria derived for arsenic to determine whether there is contamination present in this area and, if present its extent.

Appendix 7

Fieldwork Methodology

7. APPENDIX 7 FIELDWORK METHODOLOGY

7.1. Introduction

7.2. Preliminaries

Prior to commencing site work, borehole and trial pit locations will be identified, marked and finalised by URS and Rhodia in accordance with the agreed Health and Safety Method Statement procedures and flow chart, provided in the URS Health and Safety Plan. In summary, URS will initially provide Rhodia with a detailed proposed location plan. Further to review by Rhodia (and Huntsman), a site walkover will be carried out by the URS project team to finalise, agree and mark out borehole locations with a Rhodia employee (and Huntsman employee, if required). Initial scanning with a Cable Avoidance Tool (CAT) will be carried out in conjunction with consultation of the utility plans. A permit will then be issued by Rhodia, detailing each authorised location. The permit will include an agreement on the requirement of hand digging for each specific location, and to what depth digging will be performed. URS does not accept responsibility in the event of damage to buried services whose exact locations have not been brought to our attention before intrusive work begins. Prior to site works commencing, a Health and Safety Plan covering all field tasks to be carried out will be developed (as part of Task 1).

7.3. Trial Pitting

It is proposed that soil sampling is best achieved in areas of potential difficult subsurface conditions by trial pitting. This is a relatively rapid technique for investigating shallow subsurface soils and allows better characterisation of geology, potential voids and observations of contamination. Trial pitting does however cause disruption to a larger area of ground and settlement can occur upon completion of the works. It is assumed that Rhodia would have no objection to trial pitting in these areas. Trial pitting will be carried out using a tracked mechanical excavator, equipped with a breaker for use in hardstanding areas.

Following completion of trial pitting exercise, the scope for drilling work and analytical scopes will be reviewed and finalised.

7.4. Soil Bore Drilling and Monitoring Well Installation

It is proposed that drilling will be undertaken using a window sampling technique. Boreholes will be advanced to a maximum of 5m depth, where possible, although previous investigation suggest that at many locations refusals at shallower depth (due to obstructions and/or bedrock) may be likely. Groundwater monitoring wells will be installed with 50mm HDPE casing and screen completed at ground surface with a cover, painted a visible colour and surrounded by temporary fencing to prevent potential loss of integrity due to heavy vehicle movements. Waste derived from drilling will be stockpiled on site

further to laboratory analysis, after which a decision on the destination of the waste will be made. No costs have been included in this proposal for the disposal of this waste.

During drilling and trial pitting, soil samples will be screened at regular intervals for potential organic contamination using a Photo Ionisation Detector (PID) to assist in the selection of soil samples. The key organic contaminant of concern, naphthalene, has an ionisation energy of 8.13eV and therefore a PID fitted with a 10.6eV lamp will be used. Geological logging, recording of water strikes and of visual and olfactory indications of contamination will be carried out during drilling/trial pitting.

Soil samples will be taken for laboratory analysis from the proposed trial pits and boreholes to supplement the existing data set. These will be taken from a range of depths, in order to satisfy the requirements for a robust, valid and comprehensive assessment. It is proposed to take soil samples from each location for laboratory analysis (the proposed analytical schedule for these samples is presented as Task 4) including leachate testing for heavy metals in order to evaluate the leaching potential for contaminants into the underlying groundwater. In addition, duplicate soil samples and one field blank will be submitted to the laboratory for QA/QC purposes.

7.5. Surveying

New monitoring wells installed as part of this task will be surveyed for relative height in relation to the existing monitoring well network. Measurements will be made to the top of the well casing to allow groundwater elevations and flow direction to be calculated.

7.6. Shallow Groundwater Sampling

Groundwater samples will only be collected from the new shallow monitoring well network. It is understood that there are 5 existing wells located within Plot A, however the integrity of some or all of these locations are likely to have been impaired by demolition operations undertaken in this area and therefore it is considered that some or all of these locations are not suitable for sampling. The proposed analytical schedule for the groundwater samples is presented in Task 4.

Depth to water measurements will be made to allow groundwater flow direction to be determined. The wells will be purged of three times their volume prior to sampling with the objective of sampling water representative of the formation into which wells are installed. Field parameters of pH, temperature, Electrical Conductivity and Redox Potential will be taken during purging and sampling of the wells and duplicate groundwater samples and one field blank will be submitted to the laboratory for QA/QC purposes.

Appendix 8

Terms and Conditions

8. APPENDIX 8 TERMS AND CONDITIONS