# Remediation Statement Appendix L

# Stockpiles Investigation, Former Albright and Wilson Works, Whitehaven, Cumbria

30 July 2008
FINAL

Issue No 4
49308157 / MARP0001

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|---|---|
| **Project Title:** | Remediation Statement Appendix L |
| **Report Title:** | Stockpile Investigation, Former Albright and Wilson Works, Whitehaven, Cumbria. |
| **Project No:** | 49308157 |
| **Report Ref:** | MARP0001 |
| **Status:** | FINAL |
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**Document Production / Approval Record**

| Issue No: 1 | Name | Signature | Date | Position |
|---|---|---|---|---|
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| Approved by | Selena Pearce | | 30 July 2008 | Technical Director |

**Document Revision Record**

| Issue No | Date | Details of Revisions |
|---|---|---|
| 1 | 19 June 2008 | FINAL - Original issue |
| 2 | 30 July 2008 | FINAL – Minor amendments |
| 3 | 30 July 2008 | FINAL – Issue after EA review |
| 4 | 28 May 2009 | FINAL – Issue after further EA comments |

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# EXECUTIVE SUMMARY

The Former Albright and Wilson Facility, Whitehaven, Cumbria, United Kingdom is a Special Site under Part 2A of the Environmental Protection Act 1990. The site is owned by Rhodia UK Ltd, who submitted a Remediation Statement prepared by URS to the Environment Agency's (EA) Penrith Office in February 2008.

Nine stockpiles (Stockpiles 1 to 8 including 7A and 7B) of materials are present at the site as a result of a series of construction and demolition projects on site. Stockpiles 5 and 8 were not included in this investigation as the materials contained within them have been assessed in previous investigations and found to be suitable for re-use on site. The stockpiles have been stored pending use for future restoration of the site following site demolition and remediation works. Rhodia intends to reuse the stockpile material on site to reduce the gradient of a number of potentially hazardous steep slopes.

The purpose of the work reported is to provide the Environment Agency with the following information on the stockpiles:

- A method statement describing the proposed reuse of the stockpile material;
- A plan showing where the stockpile material will be reused; and
- A comparison of the chemical quality of the stockpile material with the relevant Assessment Criteria for the location where the material will be reused.

This investigation has included stockpile surveying, methodical collection of stockpile composite soil samples, laboratory testing of soil and soil leachates and generic and detailed human health and controlled waters risk assessments.

The majority of the stockpile materials have been found not to present significant risks to human health or controlled waters if used for steep slope regrading, however a relatively small proportion of materials that are marginally contaminated with lead and benzo-a-pyrene may present a potential risk to human health if present at the surface. It is proposed to use the marginally contaminated materials at the toe of existing steep slopes and cover the material with in excess of 1m of materials that are not contaminated so that the direct contact pathway to future users is broken.

Steep slopes have been identified for proposed regrading in two areas: Zones 6 and 10a (northwestern corner of the site) and Zone 10c (eastern boundary). It is considered that if the stockpile material is redeployed in the manner proposed, the risks to future users of the site from steep slopes will be reduced and there will be no significant contamination related risks to human health or controlled waters.

The regrading works will be undertaken within the framework set out in accordance with the Definition of Waste: Development Industry Code of Practice (CL:AIRE, Sept 2008). An appropriate Declaration will be obtained from a Qualified Person and sent to the Environment Agency Permitting Support Centre prior to commencement of siteworks. This obviates the need for an Environmental Permit or waste exemption.

# 1. INTRODUCTION.

## 1.1. General Introduction

The Former Albright and Wilson Facility, Whitehaven, Cumbria, United Kingdom is a site regulated as Statutory Contaminated Land and a Special Site under Part 2A of the Environmental Protection Act 1990. The land ('the site') is owned by Rhodia UK Ltd, who submitted a Remediation Statement prepared by URS to the Environment Agency's (EA) Penrith Office in February 2008. Full details of the site and the proposed remediation are presented within the Remediation Statement (reference 44320110/MARP0002, Issue 13, 4 February 2008), which has been approved by the EA.

A number of stockpiles of materials are present at the site as a result of a series of construction and demolition projects on site. The material has been stored in stockpiles pending use for future restoration of the site following site demolition and any remediation works. Rhodia intends to reuse the stockpile material on site to reduce the gradient of a number of potentially hazardous steep slopes. The stockpiles include the Plot C Stockpiles, which were identified in section 3.3.1.6 of the Remediation Statement as the subject of an Assessment Action.

The purpose of the work reported herein is to fulfil the requirements of the Environment Agency's Assessment Action, which are to provide to the Environment Agency with the following information on the stockpiles:

1. A method statement describing the proposed reuse of the stockpile material (see Section 7);

2. A plan showing where the stockpile material will be reused (see Section 7); and

3. A comparison of the chemical quality of the stockpile material with the relevant Assessment Criteria for the location where the material will be reused (see Section 5).

This report presents the objectives, scope of works and findings of the stockpile investigation undertaken at the site. The works were undertaken in accordance with URS Corporation Ltd (URS) proposal reference 03051303 dated 4 February 2008 (presented in Appendix A) and authorised by John Moorhouse of Rhodia UK Limited (Rhodia) on 21 February 2008.

## 1.2. Investigation Area

Eight stockpiles (Stockpiles 2 to 8 including 7A and 7B) of spoil material are present at the southwest of the site and Stockpile 1 is located at the northwest of the site. The stockpile locations are shown on Figure 1. URS understands that the spoil has been derived from various on site sources, including materials excavated during construction of the two surface water retention ponds (North Pond and South Pond) and dredged material from the off-site Sandwith Beck. The sources of material within each stockpile are shown in the summary table in Appendix B.

Stockpiles 5 and 8 were not included in the investigation due to the following:

- Stockpile 5 is material excavated from the North Pond area, for which URS have already obtained analysis data, which has shown it is suitable for reuse at the site (reported in the Remediation Statement).
- Stockpile 8 is surplus Ufex landfill capping material, which is natural Boulder Clay excavated from the site, for which there is plenty of analysis data available showing that there are no unacceptable risks associated with having this material reused on site.

## 1.3. Project Objectives

Rhodia intends to make use of the stockpile material to mitigate hazards on site by reducing the gradient on a number of steep slopes. Thus the aim of the current work is to recommend an appropriate course of action to reuse on site material in Stockpiles 1 to 4, 6, 7A and 7B that will not give rise to unacceptable human health or controlled waters risks.

The objectives of the works (as described in URS proposal reference 03051303) are as follows.

- Accurately determine the volume of stockpile material present;
- Identify potential hazards within the stockpile material;
- Determine potential risks to human health and controlled waters associated with the stockpile material (EA Point 3);
- Assess the stockpile material for waste classification purposes should removal and disposal be required; and
- Recommend an appropriate method for using the stockpile material to reduce the gradient of steep slopes (EA Points 1 and 2).

## 1.4. Scope of Works

The scope of work comprised the following tasks, which are discussed in further detail in later sections:

**Task 1** **Initial Works** – included updating the site-specific health, safety and environmental plan (HSEP), appointment and mobilisation of subcontractors, and arrangement and management of site logistics;

**Task 2** **Fieldwork** – included a site walkover, stockpile surveying by a specialist and methodical collection of stockpile composite soil samples;

**Task 3** **Laboratory Analysis** – involved laboratory chemical analysis of soil and soil leachate from stockpile composite samples for a selection of determinands; and

**Task 4** **Data Assessment and Reporting** – included review of fieldwork findings and laboratory testing results, completing a generic risk assessment of the data for protection of human health and controlled waters, assessing the material for possible waste classification and production of a proposed method detailing the appropriate way to deal with the stockpile material.

## 1.5. Report Layout

The remainder of this report is structured as follows:

- **Section 2** – Details of the site works;
- **Section 3** – Details of the laboratory analysis;
- **Section 4** – Findings from the site work and laboratory testing;
- **Section 5** – Contamination Screening Assessment; and
- **Section 6** – Conclusions and Method Statement.

# 2. FIELD WORK

## 2.1. Stockpile Sampling and PID Screening

The site investigation fieldworks were carried out over four days starting on 17 March 2008. Stockpiles were sampled according to the stockpile sampling strategy described in URS proposal reference 3051303 dated 4 February 2008. The sampling strategy is designed to produce results that are representative of the material in the whole stockpile.

Stockpiles were divided into sub-areas from which a number of sample increments (samples) were taken and combined to form a composite sample for that sub-area. Between two and five composite samples were generated for each stockpile. Details of the 21 composite samples taken are presented in Appendix C and the sample locations are shown in Figures 3 to 5.

The field procedure for sampling each stockpile was developed in accordance with appropriate sections of the following guidance documents:

- ISO 10381-8:2006(E). Soil Quality – Sampling – Part 8: Guidance on Sampling Stockpiles.
- ISO 10381-1:2002. Soil Sampling Quality – Part 1: Guidance on the Design of Sampling Programmes.
- BSI British Standards (PD CEN/TR) 15310-1:2006. Characterisation of Waste – Sampling Waste Materials – Part 1: Guidance of Selection and Application of Criteria for Sampling Under Various Conditions.

The sampling strategy is summarised as follows:

- Each stockpile was divided into a number of Sub Areas for sampling.
- A 'W' shape or similar was marked out in each Sub-Area and the sample positions were noted and photographed (see Figures 3 to 5). Due to the large volume of Stockpile 2, two 'W's were marked out in each Sub Area.
- The sample points were excavated to the desired depths (between 0.25m and 2.3m below the stockpile surface) using a combination of hand digging and hand augering. A soil sample (increment) was collected from each point.
- Volatile organic compound vapours from each soil sample were measured using a photoionisation detector (PID). The results from this screen are included in Appendix C.
- The samples from each Sub Area were combined to create a composite sample for that Sub Area.

## 2.2. Surveying

Two representatives from a specialist survey company (Subscan Surveys Ltd) carried out a topographical survey of the stockpiles on 18 March 2008. URS was provided with drawings showing stockpile contours and volumes. These drawings have been used to generate Figures 1 to 5.

# 3. LABORATORY ANALYSIS

Each of the 21 composite samples collected were analysed for pH, CLEA metals (see Table 1), hexavalent chromium, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons with Criteria Working Group speciation (TPHCWG), total sulphate and total phosphorus. Eight composite samples were tested for total organic carbon (TOC).

Nine composite samples were tested for leachable CLEA metals, hexavalent chromium, PAHs, TPHCWG, phosphorus, anionic surfactants and soluble sulphate.

The analytical suite is designed to cover the contaminants that are considered potential sources of contamination in the Part 2A determination, with some additions (TOC and hexavalent chromium) that assist in waste classification.

# 4. INVESTIGATION FINDINGS

## 4.1. Stockpile Volumes

Stockpile volumes were calculated by the surveyors and are presented in Appendix B. The total volume of material in Stockpiles 1 to 4, 6, 7A and 7B is approximately 8,550 cubic metres, of which approximately 46% is in Stockpile 2. The total volume of all nine stockpiles is approximately 10,300 cubic metres.

## 4.2. Stockpile Material

Composite sample descriptions are given in Appendix C. The general material types in each stockpile are given in Appendix B. The material in all stockpiles is generally described as sandy or gravelly silt. Some demolition rubble was encountered in Stockpiles 4 and 6. It is estimated that the percentage of 'oversized' material in all of the stockpiles is approximately 30%.

## 4.3. Testing Results

The laboratory certificates for the soil and leachate testing are provided in full in Appendix D.

A summary of the average concentrations of determinands in soil is presented in the table below. Where a concentration is below the method detection limit (MDL) concentration, the MDL has been used. Determinand concentrations that appear to be significantly higher than the rest of the data set are shaded grey; "significant" was determined in comparison against other values within the dataset only. It should be noted that the table is for comparison purposes only – the potential risks and more detailed evaluation are considered in **Section 5 Contamination Assessment**.

**Table 1 – Average Soil Concentrations by Stockpile**

| | Concentration in Sediment (BGS) or Soil (SP) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Determinand** | **SP1** | **SP2** | **SP3** | **SP4** | **SP6** | **SP7A** | **SP7B** | **Units** |
| Total Sulphate | 30,000 | 112,400 | 73,333 | 16,000 | 37,000 | 28,000 | 11,700 | mg/kg |
| Boron Water Soluble | 4 | 4 | 4 | 4 | 6 | 4 | 4 | mg/kg |
| Arsenic | 7 | 10 | 7 | 10 | 13 | 9 | 10 | mg/kg |
| Barium | 313 | 109 | 170 | 438 | 250 | 240 | 465 | mg/kg |
| Beryllium | 1 | 0 | 0 | 1 | 1 | 1 | 1 | mg/kg |
| Cadmium | 16 | 2 | 2 | 2 | 1 | 2 | 1 | mg/kg |
| Chromium | 150 | 42 | 33 | 34 | 29 | 37 | 23 | mg/kg |
| Copper | 31 | 46 | 25 | 19 | 34 | 22 | 23 | mg/kg |
| Lead | 21 | 138 | 21 | 33 | 24 | 24 | 31 | mg/kg |
| Mercury | 1 | 1 | 1 | 1 | 1 | 1 | 2 | mg/kg |
| Nickel | 46 | 21 | 24 | 22 | 20 | 27 | 21 | mg/kg |
| Selenium | 3 | 3 | 3 | 3 | 3 | 3 | 3 | mg/kg |
| Vanadium | 109 | 41 | 37 | 36 | 34 | 37 | 31 | mg/kg |
| Zinc | 503 | 148 | 97 | 100 | 93 | 120 | 82 | mg/kg |
| Phosphate (Ortho as PO4) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | mg/kg |
| Hexavalent Chromium | 0.3 | 0.4 | 0.3 | 0.4 | 1.7 | 0.4 | 1.7 | mg/kg |
| pH Value | 9 | 9 | 8 | 9 | 8 | 8 | 8 | pH Units |
| GRO (C4-C12) | 0.03 | 0.01 | 0.01 | 0.03 | 0.01 | 0.01 | 0.01 | mg/kg |
| Total Aliphatics C5-C35 | 463 | 122 | 65 | 123 | 280 | 62 | 73 | mg/kg |
| Total Aromatics C6-C35 | 140 | 67 | 51 | 47 | 170 | 19 | 6 | mg/kg |
| TPH (total C5-C35) | 607 | 190 | 113 | 168 | 450 | 81 | 79 | mg/kg |
| Benzo(a)pyrene | 1 | 0 | 0 | 0 | 3 | 0 | 0 | mg/kg |
| PAH (sum of 4) | 3 | 1 | 1 | 1 | 8 | 1 | 1 | mg/kg |
| PAH 16 Total | 10 | 6 | 6 | 5 | 37 | 2 | 5 | mg/kg |
| | | | | | | | | |

**Nv = no value**

The results in the table above indicate that Stockpile 1 contains significantly higher concentrations of cadmium, chromium, nickel, vanadium, zinc and TPH than material in the other stockpiles. Stockpile 2 appears to contain significantly higher concentrations of copper and lead than the other stockpiles and Stockpile 6 appears to contain significantly greater concentrations of TPH and PAH than the other stockpiles.

The chromium concentrations in all stockpiles except Stockpile 1 are between 20 and 40mg/kg. The concentrations in Stockpile 1 are 150mg/kg.

A summary of the leachate results per stockpile is similarly presented in the table below. The highest concentration for each determinand is shaded grey. It should be noted that two samples were analysed from Stockpiles 2 and 4 so the average concentration is shown, but only one sample each was analysed from the other stockpiles.

**Table 2 –Leachate Concentrations by Stockpile**

| | Concentration / Average Concentration (Leachate) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **SP1** | **SP2*** | **SP3** | **SP4*** | **SP6** | **SP7A** | **SP7B** | **Units** |
| Arsenic | 1 | 2 | 3 | 3 | 3 | 7 | 1 | µg/l |
| Barium | 32 | 97 | 38 | 47 | 45 | 11 | 32 | µg/l |
| Beryllium | 1 | 1 | 1 | 1 | 1 | 1 | 1 | µg/l |
| Boron | 30 | 416 | 20 | 23 | 120 | 20 | 46 | µg/l |
| Cadmium | 0.5 | 0.2 | 0.2 | 0.5 | 0.5 | 0.5 | 0.5 | µg/l |
| Chromium | 28 | 4 | 2 | 16 | 3 | 7 | 4 | µg/l |
| Copper | 2 | 17 | 11 | 6 | 61 | 10 | 2 | µg/l |
| Lead | 1 | 2 | 1 | 1 | 1 | 6 | 2 | µg/l |
| Nickel | 5 | 8 | 10 | 3 | 7 | 11 | 3 | µg/l |
| Phosphorus | 105 | 105 | 110 | 105 | 105 | 210 | 105 | µg/l /l |
| Selenium | 1 | 2 | 1 | 1 | 1 | 1 | 1 | µg/l |
| Vanadium | 17 | 23 | 8 | 20 | 8 | 9 | 1 | µg/l |
| Zinc | 6 | 12 | 5 | 5 | 5 | 9 | 5 | µg/l |
| Mercury | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.07 | 0.14 | µg/l |
| Hexavalent Chromium | 30 | 30 | 30 | 30 | 30 | 300 | 30 | µg/l |
| Sulphate | 1200 | 1400 | 1400 | 650 | 1400 | 67 | 870 | mg/l |
| pH | 6.7 | 8.4 | 8.0 | 7.2 | 7.0 | 8.6 | 7.3 | pH Units |
| GRO (C4-C12) | 10 | 10 | 10 | 10 | 10 | 10 | 10 | µg/l |
| TPH (total C5-C35) | 10 | 10 | 10 | 10 | 10 | 10 | 10 | µg/l |
| PAH (sum of 4) | 80 | 80 | 80 | 80 | 80 | 80 | 80 | ng/l |
| PAH 16 Total | 210 | 185 | 100 | 100 | 100 | 100 | 100 | ng/l |
| Anionic surfactant | 50 | 50 | 50 | 50 | 50 | 340 | 50 | µg/l /l |

*** = average of two results**

# 5. CONTAMINATION ASSESSMENT

## 5.1. Screening Assessment

Screening assessments were undertaken on soil and leachate data returned form the laboratory chemical analysis of the composite samples collected from the stockpiles to determine if the material would possibly present a significant risk to human health (future users of the open space) or controlled waters (the Irish Sea, Sandwith Beck) during reuse on site.

This section addresses the EA's Point 3 as described in Section 1.1. Statistical analysis of soil and leachate results from individual stockpiles was not considered appropriate as part of this exercise due to the small number of results for each stockpile.

### 5.1.1. Soils – Human Health

The human health screening assessment used either generic assessment criteria (GAC) for a residential (without plant uptake) scenario or, if available, site-specific assessment criteria (SSAC) that were developed for selected determinands (ones that exceeded the human health GAC) by URS previously for the site. The SSAC for human health were developed for a public open space scenario using a well-established conceptual site model and have been used in many human health risk assessments at this site. Details of GAC and SSAC development are given in the following previous URS report: Remediation Statement Appendix D: Plot B Soil and Groundwater Investigation, Issue 3. The human health GAC and SSAC are presented in Appendix E of this document.

Concentrations of determinands in the stockpile composite samples were compared directly to the human health GAC/SSAC. The comparison with highlighted exceedances is presented in Appendix E. Concentrations of arsenic, boron, beryllium, cadmium, chromium, copper, mercury, nickel, selenium, sulphate, phosphate, TPH and PAH did not exceed human health GAC/SSAC in soil samples submitted for analysis. Where concentrations of potential contaminants exceeded the screening criteria, details are provided below.

#### 5.1.1.1. Lead

The concentration of lead slightly exceeded the human health GAC of 450mg/kg in one sample: Stockpile 2 sample SP2A (530mg/kg) from Sub Area A;

The BGS Geochemical Atlas for the Lake District and Cumbria indicates that stream sediments in the Whitehaven area typically contain between 15mg/kg and 75mg/kg of lead. The concentrations of lead present in all but one of the composite samples fall within the above range. The concentration of lead was above the naturally occurring range in one sample (SP2A, 530mg/kg), which was taken from the southeastern corner of Stockpile 2 (see Sub Area A of Stockpile 2 on Figure 5), indicating that there could be localised elevated concentrations of lead in this part of the stockpile. The contamination screening assessment shows that this concentration of lead would be considered a potential risk to human health if it were present at the surface of the site.

However, it should be noted that this assessment is based on the GAC of 450mg/kg, which is the SGV for residential without gardens and is therefore a very conservative criteria based on the proposed use of the material within slopes on a public open space. Assuming Sub Area A is approximately one quarter of the total volume of Stockpile 2, the volume of Sub Area A is approximately 1000m$^3$.

#### 5.1.1.2. Benzo-a-pyrene

The concentration of benzo(a)pyrene exceeded the human health SSAC of 1,140ug/kg in one sample: Stockpile 6 sample SP6A (4,900ug/kg) from Sub Area A.

The concentration of BaP in (SP6A, 4.9mg/kg) from Stockpile 6 would be considered a potential risk to human health if it were present in near-surface soils (<1m) at the site. The sample was taken from the southeastern part of the stockpile (see Sub Area A of Stockpile 6 on Figure 4), indicating that there could be localised elevated concentrations of BaP in this stockpile. Assuming that Sub Area A comprises half of the volume of Stockpile 6, this equates to approximately 120m$^3$, however it is considered impractical to try to split this stockpile on site so the whole stockpile is considered to be affected.

### 5.1.2. Soil Leachate – Controlled Waters

The controlled waters receptors are considered to be the Irish Sea and Sandwith Beck.

The controlled waters screening assessment utilised GAC based on a hierarchy of published standards including UK Drinking Water Standards (UKDWS) and UK Marine/ Estuarine Environmental Quality Standards (UK EQS). The controlled waters GAC are described fully in the Remediation Statement Appendix D (as above) and are presented in Appendix E of this report.

Determinand concentrations in leachate samples were compared directly to the controlled waters GAC and the exceedances noted. The comparison and exceedances are presented in Appendix E. It should be noted that this comparison is a very conservative initial assessment of the results using stringent assessment criteria and therefore exceedances of the GAC do not necessarily indicate a potential risk.

Exceedances of the controlled waters GAC are summarised as follows:

- Leachable chromium – The concentration of leachable chromium exceeded the controlled waters GAC (UK EQS) of 15µg/l in two samples: SP1A (28µg/l) and SP4B (24µg/l);
- Leachable copper – The concentration of leachable copper exceeded the controlled waters GAC (UK EQS) of 5µg/l in seven samples: SP2A (13µg/l), SP2C (20µg/l), SP3A (11µg/l), SP4B (24µg/l), SP4D (8µg/l), SP6B (61µg/l) and SP7B (10µg/l); and
- Leachable dibenzo(ah)anthracene – Concentrations in all samples were below the detection limit of 16ng/l, which is itself above the GAC of 9ng/l (from US EPA Region 9, based on water consumption by humans).

Where these exceedences have been identified, a site specific detailed quantitative assessment was undertaken and is described in Section 5.2.

Reported concentrations of leachable arsenic, barium, beryllium, boron, cadmium, lead, mercury, nickel, phosphorous, selenium, sulphate, vanadium, zinc, TPH and PAH did not exceed controlled waters GAC.

## 5.2. Detailed Quantitative Risk Assessment – Controlled Waters

The generic controlled waters risk assessment showed that leachable chromium (in Stockpiles 1 and 4) and copper (in Stockpiles 2, 3, 4, 6 and 7B) presents a potential risk to controlled waters if the material remains on site, based on an initial assessment using GAC (UK EQS for copper and chromium). These potential risks have been considered further as follows:

Leachable dibenzo(ah)anthracene (DahA) – The concentration in every sample was below the detection limit of the method (<16ng/l), however this detection limit is above the generic screening value for controlled waters (9ng/l) so all samples are shown in Appendix E as exceeding the GAC. The screening value of 9ng/l has been used in the absence of any other available value and is based on protecting human health at the point of consumption and therefore is far too stringent to apply to the conceptual site model at this site. Therefore it is considered that concentrations within these samples do not represent a potential risk to controlled waters.

Leachable copper – The concentrations identified in this investigation (11µg/l to 61µg/l) are consistent with concentrations identified in previous URS investigations of Plot D (1µg/l to 63µg/l) and Plot E (7µg/l to 22µg/l). The investigation of Plot D (Remediation Statement Appendix F: Plot D Soil and Groundwater Investigation) stated that the elevated leachable copper concentrations observed at the site are due to the presence of elevated concentrations of naturally occurring copper in the area. Also, the shallow groundwater in Plot D (in monitoring well WS416) was found to contain a concentration of copper equal to the screening value, which was considered attributable to the natural soil concentrations. It is therefore considered that the observed leachability of copper does not present a significant risk to controlled waters (the Irish Sea, Sandwith Beck). Furthermore, it is unlikely that a pathway exists from the stockpiles to either the Irish Sea or Sandwith Beck, for the same reasons as described in the evaluation for chromium below.

Leachable chromium – The concentrations identified in this investigation (SP4B, 24µg/l and SP1A, 28µg/l) are very similar to the maximum concentrations identified in previous URS investigations of Plots B (30µg/l) and Plot E (25µg/l) of the site. The risks from leachable chromium in Stockpiles 1 and 4 have been assessed further using the site-specific controlled waters risk assessment model that was developed for the site by URS (see Remediation Statement Appendix C, Plot A Soil & Groundwater Investigation). This model has been used previously across the site to assess risks to controlled waters from the in-situ contaminated soils and is considered equally applicable to the stockpile material.

The model calculates the dilution that would occur between the leachable source (material in Stockpiles 1 and 4) and the receptor (the Irish Sea). The model assumes that the material is located on the surface over a dissolution feature (a rapid transport pathway), which is a worst-case scenario with regard to leachates travelling towards the Irish Sea. The model allows the thickness of the layer of contaminated stockpile material and the concentration of chromium in the material to be manipulated to identify the scenarios that give rise to exceedances of the GAC (UK EQS) at the Irish Sea.

Using this model is considered to be a very conservative approach for the following reasons: The entire volumes of Stockpiles 1 and 4 have been considered but in reality are not affected by elevated chromium; large parts of the site are covered with a layer of boulder clay, which is likely to reduce the amount of vertical migration down to the groundwater system and therefore the amount of infiltrated water/leachate reaching the Irish Sea; and all of the material is unlikely to be present over a dissolution feature.

Various values for the depth of the material and the concentration of leachable chromium were entered into the model. If the theoretical depth of the material is increased, the area covered by the material is reduced, which reduces the amount of infiltration and resulting volume of leachate. Therefore the greater the depth of material, the lower the theoretical potential risk to the Irish Sea. The details of the risk assessment model and the model output are presented in Appendix F. A summary of the model output is presented in Table 3 below.

**Table 3 – Summary of output of Site-Specific Controlled Waters Risk Assessment Model for Chromium**

| Volume of Material in SP 1 and SP4 ($m^3$) | Thickness Spread on Site (m) | Chromium Concentration (µg/l) (UK EQS - 15µg/l) | |
|---|---|---|---|
| | | At Source | At Receptor (Irish Sea) |
| 3100 | 1 | 28 | 10.4 |
| 3100 | 1 | 40 | 14.7 |
| 3100 | 0.5 | 28 | 14.9 |

The above table shows that based on a volume of 3100 cubic metres of material (the total volume of Stockpiles 1 and 4), a worst-case placement scenario (above a dissolution feature) and assuming that the average chromium concentration within the stockpiles is 28µg/l (the concentration in Stockpile 1), the minimum theoretical thickness that the material can be spread on the site to keep the resulting theoretical concentration at the Irish Sea below the UK EQS is calculated as 0.5m.

The model indicates that if all of the material from Stockpiles 1 and 4 were spread at a thickness of 1m, the controlled waters screening value would not be exceeded unless the leachable chromium concentration in the material is actually above 40µg/l.

The shallow pathway for migration of waters potentially containing chromium leachate to the Sandwith beck is not considered further due to:

- The proposed location of the slope to be regraded which lie on the northern side of the water threshold, so overland drainage will be away from the Sandwith Beck;
- The rapid pathway through the geology beneath the site is more conservative than the pathway through shallow soils and made ground to the Sandwith Beck due the greater retardation and dilution which would occur and so it is considered that if a significant pollutant linkage is not identified by the rapid pathway model, it will not be identified by the shallow groundwater model.

## 5.3. Implications of the risk assessment for use of the stockpiles

### 5.3.1. Human Health

Based on potential risks to human health from direct contact, material from Sub Area A of Stockpiles 2 and 6 (total volume approximately 1100$m^3$) should not be used within 1m of the surface of the regraded slopes. This is due to slightly elevated concentrations of lead and benzo-a-pyrene.

It should be noted that the above conclusion is based on a worst-case very conservative risk assessment. Within the public open space, the material will form part of a slope, which is unlikely to be used by future users of the site for sitting or eating on and therefore, even if the material were present at the surface the risks of direct contact are considered to be much lower than the risk assessment would suggest.

### 5.3.2. Controlled Waters

It is proposed that the stockpile material is used to reduce the gradient of steep slopes on site. The thickness at which the material will be spread against the steep slopes is likely to be greater than 1m over a vast majority of the area to be covered. Regarding leachable chromium in Stockpiles 1 and 4, the site specific controlled waters risk assessment model described in Section 6.2 indicates that the greater the thickness of material (i.e. less area covered) the more it is protective of controlled waters. It also follows that if the area used to spread the material is kept to a minimum, there is less chance that the material will be located over a dissolution feature. It is therefore concluded that there are no significant risks to controlled waters associated with the stockpile materials if they are used to reduce the gradient of steep slopes on the site. However, the risk assessment indicates that spreading all of the material from Stockpiles 1 and 4 out in thin layers (<0.5m) over large areas of the site would be undesirable.

# 6. WASTE MANAGEMENT ISSUES

## 6.1. Are the stockpiles “waste”?

Rhodia retained the stockpiled material on-site because it was envisaged that during the remediation and restoration works, additional fill would be required in order to level the site, and this remains the case. However, the fact that the stockpile materials contain elevated concentrations of some determinands that may classify the material as ‘contaminated’ requires consideration.

The Environment Agency’s guidance “The Definition of Waste”, April 2006 advises that contaminated soils for which a specific, certain use exists are not considered to be waste provided that the proposed use does not pose unacceptable risks to the environment. The criteria that must be met are:

- The material must be suitable for use without further treatment;
- Only the quantity required for the use can be used; any remainder would be waste; and
- The use must be a certainty, not a possibility.

According to the sampling, testing and risk assessment completed, the majority of the soils present in the stockpiles (approximately 9200m$^3$) satisfy the above three criteria. Approximately a tenth of the total amount of stockpile material (approximately 1100m$^3$ from Stockpiles 1 and 4) is required to be used in the regraded slopes at a depth greater than 1m to protect human health, however this is not a ‘treatment’ and therefore this material also satisfies all three criteria. It is therefore concluded that the stockpile material that will be required for Rhodia’s proposed application is not “waste”.

## 6.2. Waste classification for any surplus material

If there is material that is left over from regrading the slopes, then this material is likely to be considered a waste. In order to facilitate disposal, or alternative uses, URS has carried out a waste classification assessment. New guidance was published in May 2008 by the Environment Agency, and the assessment was undertaken according to the new version of WM2, 2$^{nd}$ Edition Version 2.2.

It was concluded that the stockpiles are not considered to exhibit any hazardous properties that would render the material hazardous waste if disposal were required.

Any surplus material should therefore be disposed of to an appropriately permitted landfill site as non-hazardous waste. Waste acceptance criteria (WAC) testing is not required for non-hazardous waste. It is very unlikely that any of the stockpile material would be considered as inert waste because of the site’s contaminated land status.

# 7. PROPOSED STOCKPILE REUSE METHOD STATEMENT

## 7.1. Introduction

Rhodia intends to use the stockpile materials to reduce the gradient of the steep slopes to reduce safety risks to future public users of the site. The steepest slopes currently have a gradient of less than 1 in 1 (<45 degrees). The risks associated with the steep slopes have been considered in the Trespasser Risk Assessment already completed by Rhodia.

## 7.2. Chemical suitability for use

The risk assessment has shown that the majority of available stockpile materials would not present risks if reused at any location or position elsewhere on site. There are two exceptions where stockpile materials could present a potential risk to human health if used in near-surface soils as follows:

- Elevated lead concentrations in Sub-area A, southeastern quarter of Stockpile 2;
- Elevated benzo-a-pyrene (BaP) concentrations in Sub Area A of Stockpile 6.

In addition, material from Stockpiles 1 and 4 should not be spread in a thickness of less than 0.5m to protect controlled waters.

The volumes and limitations on use are summarised in the table presented in Appendix G.

Section 7.5 sets out a suggested methodology for ensuring that the above limitations are considered for the successful redeployment of stockpile materials.

## 7.3. Physical suitability for use

The slopes to be created are not required to support loads beyond their own weight, and are not required to be trafficked. Since the physical suitability criteria do not require an engineering specification, it is considered that a simple qualitative assessment is a sufficient test of physical suitability.

The stockpiles have different physical properties as a result of different origins. The materials can be described as general fill consisting of coarse granular material including recycled aggregate. In addition, they comprise a wide range of particle diameters including oversized materials and reinforcing steel bars.

Considerations affecting the physical suitability of these materials for reuse are:

- Stability – The stockpiles have been in place for a number of years without displaying excessive physical instability or subsidence even where heaped at gradients in excess of 1 in 3. This is attributable to the good slope-forming ability of coarse granular materials containing a wide range of particle sizes. The materials will be used to reduce the gradients of steep slopes on the site. There is every indication that slope reduction will improve physical stability rather than promoting instability.

- Particle size – As previously noted the materials comprise a wide range of particle diameters including oversized material and reinforcing steel bars. This has not obviated the creation of reasonably smooth surface finishes as evidenced at Stockpile 4 (see photographs of stockpiles in Appendix H). With appropriate handling methods a good surface finish should be achievable for all regraded slopes.

- Surface erosion - Scouring of regraded slopes by runoff from slab areas at the top of the slopes is a potential issue. Left alone, the stockpile materials will eventually establish ruderal grass cover and other plant growth as evidenced by existing slopes, which can help prevent gullying and washout. Where needed, completed surfaces can be grass seeded to hasten the establishment of suitable cover planting, and drainage channels can be created to divert overland flows away from areas vulnerable to surface erosion.

Section 7.5 sets out a suggested methodology for ensuring that these considerations are taken into account for the successful redeployment of stockpile materials elsewhere on the site.

## 7.4. Proposed locations for stockpile materials

Steep slopes have been identified for proposed steep slope regrading in two areas: Zones 6 and 10a (northwestern corner of the site) and Zone 10c (eastern boundary) (see 44319623/Figure 2 from previous report in Appendix I).

Marginally contaminated materials from Sub-area A of Stockpile 2 and Stockpile 6 will be used at the toe of existing steep slopes and non-contaminated stockpile materials will be used to cover it.

Material that is obviously oversized and/ or containing appreciable quantities of rebar can be deposited at any of the identified areas as long as they are not at the surface.

Remaining stockpile materials which are easier to handle can then be deposited to form a cover layer of not less than 1.0m over the areas where Stockpile 6 and Sub-area A/ Stockpile 2 materials as well as the oversized and steel-bar containing materials have been deposited.

## 7.5. Proposed method for recovery and reuse of stockpiled materials

The regrading works will be undertaken within the framework set out in accordance with the Definition of Waste: Development Industry Code of Practice (CL:AIRE, Sept 2008). An appropriate Declaration will be obtained from a Qualified Person and sent to the Environment Agency Permitting Support Centre prior to commencement of siteworks. This obviates the need for an Environmental Permit or waste exemption.

The following methodology is suggested to ensure successful recovery and reuse of the stockpile materials:

**1) Preparatory works**

- Stockpile 6 and Sub-Area A of Stockpile 2 must be clearly delineated to identify and keep these materials separate from the other stockpile materials.
- The areas where the materials are to be redeployed should be identified, and safe working in/ under these areas should be confirmed in advance.
- Any wastes or otherwise deleterious materials which cannot be described as general fill consisting of coarse granular material including recycled aggregate should be cleared away from these areas.
- All previously installed monitoring wells should be clearly marked out and coned off or otherwise protected so that they are clearly visible to minimise the possibility of damage during the works. Any monitoring points damaged or destroyed are to be assessed to see whether they need to be repaired or replaced on completion of the works.

**2) Managing the earthworks**

- A Materials Management Plan in accordance with Definition of Waste Development Industry Code of Practice has been drawn up (attached as Appendix J) to ensure that identified materials are deposited as described. This plan includes expected quantities, types of plant and equipment to be used, haulage routes and methods of excavation and placement.
- An environmental management programme should also be established during the works to minimise the impacts of dust, debris and mud generation.
- As a minimum, the programme should consider dust suppression by spraying haulage routes with water. Conversely road sweeping should be considered to prevent debris and mud being carried onto the public highway.
- The programme should consider if cut-off drains or bunds are needed to prevent runoff containing suspended solids and other substances from entering the onsite ponds.

- Formal validation of the earthworks is not anticipated to be needed beyond ensuring by visual inspection that the earthworks plan has been complied with.

**3) Excavation and deposit of sub-surface layer**

- Materials from Stockpile 6 and Sub-Area A of Stockpile 2 must be excavated and deposited at the toe of the steep slopes first.
- Other stockpile materials that are obviously oversized and/ or containing appreciable quantities of rebar should then be deposited.
- Excavation and deposition operations should be in compliance with Defra's *Good Practice Guide for Handling Soils.*

**4) Excavation and deposit of cover layer**

- Materials from the remaining stockpiles should be excavated and deposited to form a cover layer of not less than 1.0m over the sub-surface layer.
- Materials that are obviously oversized and/ or containing appreciable quantities of rebar should be deposited at the bottom of the cover layer and not at the surface.
- All new slopes created should have a gradient not exceeding 1 in 3. It is expected that all the stockpile materials will be used up with no surplus remaining. Existing slopes may be further regraded to match the 1 in 3 gradient. No further materials import is expected to be required.
- Compaction of the cover layer by earthmoving plant should be minimised. Where necessary, soil decompaction should be undertaken when the finished slopes have been created.
- Excavation and deposition operations should be in compliance with *Defra's Good Practice Guide for Handling Soils.*

**5) Aftercare**

- Control of surface water runoff should be considered to minimise the possibility of washout, gullying and other erosion damage to the new landforms.
- Runoff flow can be managed through sub-surface perforated land drains or drainage channels. Both require a suitable outfall point where water can be borne away without causing damage to the landform.
- Over time, ruderal grass cover and other plant growth will establish naturally on the surface of the landform, though consideration may be given to grass seeding to help speed up the establishment of cover planting.
- Cover planting will help to reduce rainfall infiltration hence minimising the creation of leachable content. In addition, grass cover can act as a further separation layer, protecting end users from direct contact with subsurface materials.

- It is envisaged that the site will remain fenced off without public access until transferred to a long-term land management partner. This will minimise the possibility of the deposited materials being inadvertently disturbed by trespassers.

- It is anticipated that areas of residual risk would be identified in site records e.g. the site Health and Safety File, and existing protective measures safeguarded through a covenant or other means imposed on the future land management partner.

# 8. CONCLUSION

Rhodia propose to use the stockpile materials that have been present on the former Albright and Wilson site in Whitehaven for a number of years to regrade existing steep slopes to reduce risks to future users of the site when it is opened as public open space.

The majority of the stockpile materials have been found not to present significant risks to human health or controlled waters if used for this purpose, however a relatively small proportion of materials that are marginally contaminated with lead and benzo-a-pyrene may present a potential risk to human health if present at the surface due to possible direct contact.

It is proposed to use the marginally contaminated materials at the toe of existing steep slopes and cover the material with in excess of 1m of materials that are not contaminated so that the direct contact pathway to future users is broken.

Steep slopes have been identified on the site and a proposed method statement for the redeployment of the stockpile materials has been presented. The works will be executed within the framework of CL:AIRE's Definition of Waste: Development Industry Code of Practice. It is considered that if the stockpile material is redeployed in the manner proposed, the risks to future users of the site from steep slopes will be reduced and there will be no significant contamination related risks to human health or controlled waters.

# Figures

# Appendix A - URS Proposal

# Appendix B - Stockpile Summary Table

# Appendix C - Stockpile Sample Table

# Appendix D - Laboratory Certificates

# Appendix E - Human Health and Controlled Waters Generic Quantitative Risk Assessment

# Appendix F - Site Specific Controlled Waters Risk Assessment for Chromium

# Appendix G - Summary of Stockpile Volumes and Limitations on Use

# Appendix H - Photographs

# Appendix I – Previous Zones figure 44319623/Figure 2

# Appendix J –

# Materials Management Plan