

# 1. INTRODUCTION

This Appendix provides a report of the field works and laboratory chemical analysis undertaken to meet the objectives defines in Section 2 of the main report. The justification for the scope of works, sample locations and analytical suite are presented, in the URS proposal 130306/SAB/FXW/AJW (dated 13<sup>th</sup> March 2006), along with subsequent correspondence with the Environment Agency in Appendix E.

The soil and groundwater investigation undertaken as part of the additional measures required by the preliminary remediation statement<sup>1</sup> was undertaken as a series of tasks as summarised below:

- Task 1 Preliminary Works
- Task 2 Site Works
- Task 3 Laboratory Testing
- Task 4 Data Assessment, Refining Conceptual Model, and provide remedial actions (Details of the Data assessment and detailed quantitative risk assessment are provided in Appendix D)

### 2. TASK 1 – PRELIMINARY WORKS

Prior to commencement of site works, preliminary work was undertaken which focused on the generation of a Health and Safety Plan for pending site works. The plan was reviewed and authorised by Mark Smallbones (Health and Safety Representative for the Manchester Office), Andrew Doerr (Project Manager), and Frank Wigley (Technical Director). URS approved subcontractors were mobilised. This included Trial Pitting Operators (Hewdens), Drilling Firm (Global Probing and Sampling), and Topographic Levelling Team (Survey Systems).

Mobilisation to site occurred on 27<sup>th</sup> June 2006. On arrival at site, a site walkover was conducted by the URS field engineer and the Rhodia representative. A discussion was held to assess the scope of the site works. Central to this discussion was the identification of underground services in the area. Once this had been completed, each location was agreed and cleared with a Cable Avoidance Tool (CAT Scan). At this point, the Rhodia supervisor issued a permit, authorising intrusive works at each of the identified locations.

The Site Safety Officer (SSO) conducted a Health and Safety induction with the subcontract Trial Pitting Operator (Hewdens) and Drilling Operator (Global Probing

<sup>&</sup>lt;sup>1</sup> Former Albright and Wilson Works, Whitehaven, Cumbria: Site Remediation Statement. Rhodia UK Ltd, URS. May 2006. (ref: 44319877/R2234.B01)



Sampling), discussing safe methods for the intrusive works. The intrusive site works commenced at 11am on 27<sup>th</sup> June 2006 and was completed on 5<sup>th</sup> July 2006.

## 3. TASK 2 – SITE WORKS

#### 3.1. Investigation Locations

The follows tables provide a breakdown of the rationale for the location of each borehole and trial pit. Each sample has been given a (C) reference e.g A108 (C). Given the number of investigations on this site, and subsequent high volume of Trial pit and Borehole locations, this reference has been provided as a unique reference to samples taken within Plot C.

Reference		Location	Rationale
Trial Pits	A108 A109 A110	Within North Ponc footprint	To assess the level of contamination within the soils that are to be excavated, and to determine whether additional soil requires remediation in order to ensure that the pond area is suitable for use.
	A111		To achieve better understanding of the distribution of TPH contamination in the hotspot area, and to increase sampling density. Will also serve to assess whether TPH contamination may be capable of migrating towards South Pond. The locations are selected to fill gaps in the previous investigation, and approximately target the nominal "edge" of the potentially contaminated area.
	A113	Within area of TP⊢ contamination	
	A115		
	A114		
	A116		
	A112	Eastern Side of North	To determine the condition of the soil and groundwater potentially migrating into North Pond from the east (central areas of site,
	A117	Pona	formerly production and storage areas).

Reference		Location	Rationale	
Boreholes	BH707	Western Side of North Pond	To determine the condition of the soil and groundwater potentially migrating into North Pond from the west (near the Hutbank Landfill). Furthermore, attempt to install monitoring wells to understand the long term groundwater quality at the location.	
	BH713	Eastern Side of North Pond	To determine the condition of the soil and groundwater potentially migrating into North Pond from the east (central areas of site, formerly production and storage areas). Furthermore, attempt to install monitoring wells to understand the long term groundwater quality at the location. BH709 is close to previous location WS410, which no longer exists (was not installed).	
	BH710		Locations selected to increase coverage of groundwater sampling	
	BH711	within area of TPH	in the TPH hotspot area. In the previous investigation little groundwater was encountered, therefore additional depth planned (up to 8m). Locations are selected with reference to the previous investigation, and are intended to both delineate	
	BH712	contamination		
	BH714		contamination and assess possible migration via groundwater.	
	BH701 BH702	South of TPH area and North Pond	Locations selected to assist in the understanding of the condition of any groundwater migrating from the main area of investigation, towards Sandwith Beck	

The location of Trial Pits and boreholes advanced during this investigation are included on Figure 2.

### 3.2. Trial Pitting

Trial pitting works were conducted between 27 June and 5 July. Ten locations were advanced using a JCB 3CX backhoe excavator to a maximum depth of 5m bgl. Where necessary a hydraulic breaker, attached to the backhoe arm, was used to advance though layers of concrete and other foundations encountered during the investigation. As far as reasonably possible different soil types were separated into different piles on excavation to assist in geological logging and to make backfilling easier.

Soils inspection and sampling was undertaken as described in Section 3.4 and the trial pits backfilled with arisings in the reverse order to their excavation. Trial pits were then informally compacted using the bucket and wheels of the excavator.

### 3.3. Drilling Works

Drilling works were conducted between 28 June and 5 July. Eleven boreholes were advanced to up to 8m below ground level. Boreholes were advanced using a track



mounted *Archway1600* type drilling rig (Window(less) sampler). This technique drives a metal sampling tube 100mm in diameter and 1000mm in length containing a single use acetate liner into the ground using a hydraulically driven falling weight. A metal casing is driven into the ground along with the sampling tube facilitating the extraction of the sample core after each successive meter and preventing the collapse of the borehole sides and consequent cross contamination of the soils yet to be sampled.

At two locations (BH712 and BH713) boreholes were advanced in trial pit locations where the concrete layers had already been breached using a hydraulic breaker mounted on the backhoe excavator. Where this was undertaken, drill casing was lowered into the trial pit, and the trial pit backfilled with arisings around it until the ground surface has been reinstated. The 'Windowless Sampler' was then lowered inside the casing to the base of the trial pit. Drilling then commenced, with the sampler advancing into the undisturbed ground below the trial pit.

The process of inspection of he soil cores and collection of samples is described in ful in Section 3.4.

A groundwater monitoring well was installed in 10 of the 11 locations, using 50mm HDPE casing and screen, an inert gravel pack and bentonite seal. At the locations where boreholes were installed in former trial pits, care was taken to ensure no screened sections of pipe were installed within the trial pit backfilled material as potentially contaminated shallow horizons may have been mixed with deeper clean horizons during the backfilling process.

Top hat type covers have been used to reduce the potential for the loss or damage to the borehole, given the likelihood of heavy plant machinery operating in the investigation area during future groundworks. One borehole (BH714 C) encountered a refusal at a depth of 3.2mbgl, this was reinstated using bentonite.

Samples were placed directly into laboratory supplied containers and stored under chilled conditions prior to dispatch to the laboratory.

### 3.4. Soil Inspection and Sampling

The geological sequence observed was logged by a URS field engineer as the excavation progressed, and soil samples were collected for headspace screening and laboratory analysis. During logging and soil sampling, visual and/or olfactory indications of contamination in the returns were recorded. In addition, headspace analysis was conducted on samples selected from horizons where there was visual or olfactory evidence of contamination or where there were pertinent changes in the geology. Where these indicators were not present samples were selected for headspace analysis from regular intervals. By combing these methods samples were collected at least every meter and screened using a photoionisation detector (PID meter) fitted with a 10.6 keV bulb to assess the potential for chemical impact from volatile hydrocarbons. Where contamination was observed either directly or though use of the PID, samples where submitted for confirmatory laboratory analysis.



Samples selected for laboratory chemical analysis were placed directly into laboratory supplied containers and stored under chilled conditions prior to dispatch to the URS approved laboratory (Alcontrol Geochem).

### 3.5. Groundwater Sampling

Measurement of the depth to water (or free phase oil product below ground level) was conducted on 19<sup>th</sup> July 2006 using an oil/water interface probe.

Prior to groundwater sampling, monitoring wells were developed and purged of at least three times the well volume or until groundwater parameters stabilised. In the event that a well purged dry, a sample of the recharge water was taken. Groundwater parameters to be monitored on-site included pH, temperature, conductivity and redox potential.

Groundwater sampling was undertaken on 19<sup>th</sup> July 2006 using a peristaltic pump and dedicated tubing. Samples were placed directly into laboratory supplied containers and stored under chilled conditions prior to dispatch to the laboratory.

### 3.6. Levelling

A levelling survey of all boreholes relative to Ordnance Datum and the grid co-ordinates was conducted by a specialist sub-contractor (Survey Systems) on 19<sup>th</sup> July 2006. The depth to the top of the pipe and the cover level was measured and used in conjunction with the groundwater data to determine the groundwater flow direction.

### 3.7. Rising Head tests

In order to gain an understanding of the hydraulic conductivity of the soils within Plot C for use in the modelling, rising head tests were performed. A rising head test involves the removal of a slug of water (using a bailer) from a groundwater well and the subsequent monitoring of the recovery of the water level in the well as it fills back up within inflowing groundwater. The rising head tests are discussed in Section 5.1.2.

### 3.8. Task 3 - Laboratory Testing

As stated in Section 3.1.2 of the Remediation Statement<sup>2</sup>, the final analytical schedule was determined by the ground conditions encountered at the site during the investigation. The drilling returns did not provide evidence of a continuous groundwater table and so in the absence of water (and therefore the opportunty to obtain groundwater samples), more deep soil samples were taken than were originally planned to facilitate a better characterisation of potential contamination to depth. Leachate samples were also scheduled from the soil samples in order to gain an understanding of the potential concentrations that may be leached from the soil (and subsequently enter the groundwater).

<sup>&</sup>lt;sup>2</sup> Former Albright and Wilson Works, Whitehaven, Cumbria: Site Remediation Statement. Rhodia UK Ltd, URS. May 2006. (ref: 44319877/R2234.B01)

The analytical suite was determined by the contaminants of concern identified within the conceptual site model derived by Copeland Borough Council, and the further information obtained through URS' Phase II investigation as well as review of the historical processes undertaken at the site. The rationale for the final analytical suite is discussed in full I Appendix E. A summary of the samples submitted for analysis is presented below:

Numbers of analyses							
Analyte	Groundwater	Soils	Leach tests (NRA method)				
TPH CWG (incl BTEX/MTBE)	(7)	(14)	(0)				
VOCs (standard target list)	(4)	(14)	(0)				
TPH C10-C40	(0)	(14)	(14)				
SVOCs (standard target list)	(7)	(28)	(14)				
Metals (As, Cd, Cr, Cu, Ni, Zn, Pb, Hg, Se)	(7)	(28)	(14)				
Cyanide (total)	(7)	(28)	(14)				
Total Phosphorus	(7)	(14)	(14)				
Phosphate	(7)	(14)	(0)				
Fluoride	(2)	(14)	(0)				
MBAS	(7)	(28)	(14)				
Sulphate (water soluble)	(0)	(28)	(0)				
Particle Size Distribution	(na)	(2)	(0)				
рН	(7)	(28)	(14)				
Total Organic Carbon	(0)	(2)	(0)				
Major Cations and Anions	(2)	(0)	(0)				
WAC TESTS	(0)	(2)	(0)				

KEY: (2) - Number proposed in the Remediation Statement (REF: 44319877/ R2233.B02), 6<sup>th</sup> June 2006.

The sampling strategy was in accordance with standard sampling procedures adopted in previous investigations (see Appendix E)