LU UK VII Sarl

FORMER AKZONOBEL SITE - SLOUGH

REMEDIATION COMPLETION AND MMP VERIFICATION REPORT

BUCKINGHAM

Buckingham Group Contracting Limited
Silverstone Road
Stowe
Buckingham
MK18 5LJ

Report Reference: BGCL-C19019/007/v1

February 2021

DRAFT

Table of Contents

DRAFT

List of Tables

List of Figures

List of Appendices

DRAFT

1.0 INTRODUCTION

Buckingham Group Contracting Limited (BGCL) is contracted by First Panattoni Ltd to complete infrastructure and enabling works for commercial / industrial redevelopment at the former AkzoNobel Site, Slough. The site covers an area of approximately 33 acres near the Slough City centre and is located off Wrexham Road, Slough, Berkshire SL2 5DS. The site is centred on National Grid Reference (NGR) 498684, 180207 and is at an elevation of approximately 29 to 31m above ordnance datum (AOD) and is generally flat lying with a slight fall to the south. A Site location plan is included as **Figure 1**.

The site is located within a mixed commercial and residential area and is bounded to the north by the Grand Union Canal and the south by a railway line. Wexham Road forms the western site boundary, and the east of the site is bounded by a Cadent Gas property (former Gas works) and Uxbridge Road beyond.

The site is divided into 3 Phases as shown on **Figure 2**. Phase 1 and Phase 2 area located in the northern section of the site and will be redeveloped for mixed use comprising part B2/B8 sui generis and/or data centre use (and associated infrastructure) and Phase 3 will be redeveloped for multi-storey residential apartments with associated access and car parking and limited soft landscaping. This report covers the Phase 1 and Phase 2 commercial areas of the site.

The site is being redeveloped under Slough Borough Planning permission planning permission P/00072/096. The site has been further divided into Site Work Zones as shown on **Figure 3**.

Historically the site has been used for paint and coating manufacture from 1919 until operation ceased in 2018. Prior to this the site was utilised for brickearth excavation and brick making in the late 1800s as well as for a US/Canadian Army Storage Base between 1914-1918. More recently the site has mainly been used for the production and distribution of latex and alkyd resins, water-based paints and solvent based finishes. The site contains several bulk material storage tank farms (solvents, petroleum, and resins), plus drum storage, substation, and boiler plants.

Site geology generally comprises a variable thickness of Made Ground (typically between 1.0 – 1.5m) directly underlain by between 5m and 9m of the Taplow Gravel Member, which are in turn underlain by up to 39m thickness of the Lambeth Group. The underlying bedrock is the Seaford and Newhaven Chalk Formation. The Taplow Gravel member is classified by the Environment Agency as a Principal Aquifer and the Lambeth Group as a Secondary A aquifer. The Seaford and Newhaven Chalk is classified as a Principal Aquifer. The more cohesive and lower permeability strata of the upper Lambeth Group are acting as an aquiclude between the Taplow Gravel Member and the deeper Chalk aquifer.

The site is located within a Zone III (Total Catchment) groundwater source protection zone (SPZ), with the Zone II (Outer Protection) and Zone I (Inner Protection) located approximately 80m to the southwest and 915m to the west of the site respectively. The closest groundwater abstraction for the site is located 1.25km west. Review of regional boreholes (SU98SE87, SU98SE95 and SU98SE888) suggests that the abstraction is from the Chalk Aquifer.

The nearest surface waters to the site are the Grand Union Canal along the northern site boundary and the culverted course of the Dachett Brook, which is understood to be present beneath Uxbridge Road immediately east of the site. The Canal is not considered to be a likely receptor due to its elevated position in relation to the site coupled with its upgradient location. Similarly, the Dachett Brook is not considered a receptor due to its culverted nature and location up-hydraulic gradient from the site.

Historical land use has left a legacy of contamination on the site, particularly in Phases 1 & 2 , where past uncontrolled waste disposal has resulted in significant soil and groundwater contamination including low chain length hydrocarbons (BTEX and TPH), PAHS, free phase and dissolved phase

hydrocarbons, resins, paint thinners and pigments and buried partially filled drums, tins and paint cans. The main areas of contamination are summarised below:

Tank Farm A/Plume 1
Groundwater contamination including dissolved phase BTEX, TPH and alcohols, as well as free phase hydrocarbon and elevated TPH concentrations in unsaturated soils. Buried drums, tins and gross paint contamination was also encountered during historical ground investigation works at some locations.

Plume 2
A localised plume of dissolved phase BTEX and TPH with occasionally elevated concentrations in the unsaturated soils.

Plume 3
Historic solvent and oil storage and industrial use since the 1930s. Identified contamination includes dissolved phase BTEX, TPH, chlorinated solvents and PAHs as well as free phase hydrocarbon, elevated TPH concentrations and localised asbestos in the unsaturated soils. Significant buried drums, tins, oily rags, waste wood and gross hydrocarbon contamination in two large burial pits

Plume 4
Groundwater plume with elevated dissolved phase BTEX, TPH and naphthalene. No significantly impacted unsaturated soils or historical land use in this area to suggest an active source, and groundwater contamination is considered to represent a down gradient continuation of dissolved phase Plume 3, re-entering the site after passing beneath the adjacent Cadent gasholder.

Remediation of this contamination has been undertaken in accordance with the following document, which was approved by the regulatory bodies including the local contaminated land officer and the Environment Agency:

- BGCL, "*First Panattoni, Former AkzoNobel Site-Slough, Remediation Scheme for Contamination*", reference BGCL-C19019/001/v5, dated 31 March 2020.

The remediation works comprised a multi-phase phased approach including the following:

- Additional targeted delineation and site wide ground investigation
- Targeted abstraction and offsite disposal of floating free phase hydrocarbons on the groundwater
- Provision of a downgradient permeable reactive barrier (PRB) to intersect and treat residual dissolved phase contamination.
- Excavation and segregation of historical disposed waste and associated contaminated soils
- Direct injection treatment of the dissolved phase groundwater plumes with Oxygen Release Compound (ORC)
- Ex-situ bioremediation of excavated soils and offsite disposal of segregated extraneous materials
- Ongoing regular groundwater quality monitoring

In accordance with the Remediation Scheme for Contamination this report has been prepared for the client and the regulatory authorities to demonstrate that works have been completed in accordance with the strategy and specifications. The report will be submitted to the Planning Authority for approval and to CL:AIRE as the Materials Management Plan Verification report.

2.0 PERMITS AND PERMISSIONS

Prior to the commencement of works the following permits, protocols and permissions were obtained:

- Buckingham Group Mobile Plant Permit
  To enable onsite remediation treatment of soils, free phase and dissolved phase contamination and set out Pollution Control and Emissions Monitoring for the remediation works.

- CL:AIRE Materials Management Plan
  To enable reuse of suitable site won, remediated soils in the final development.

- Thames Water Utilities Ltd Trade Effluent Discharge Consent

Copies of the Mobile Plant Deployment approval, CL:AIRE MMP declaration, Trade Effluent Discharge Consent and Aggregate Protocol are included in **Appendix 1**.

DRAFT

3.0 SITE SET UP

3.1 Mobile Plant Treatment Areas

In accordance with the Mobile Treatment Plant deployment two dedicated quarantine – ex-situ bioremediation areas were constructed in the central north of the site. Each area was constructed on impermeable hard standing and bunded with geotextile wrapped site won Taplow Gravels. All pre-existing drainage and services around the treatment - quarantine areas were traced and blocked/bunded for the duration of the bioremediation works and a leachate/runoff collection sump provided.

Each treatment area was provided with a ramped entrance/exit and spill kits were provided at each site, as well as deploying scented odour suppressant and demolition dust suppression spray units at the treatment areas.

An as built survey plan and photographs of the treatment areas are included in **Appendix 2**.

3.2 Free Phase Hydrocarbon Tank

A dedicated steel 33,000l tank with a 110% capacity cemented breeze block constructed bund was provided on concrete hardstanding beneath the former Building 46 canopy in the centre of the site for the temporary storage of recovered free phase prior to classification testing and offsite disposal.

All existing site drainage in the surrounding area was clearly identified, marked out and protected by absorbent filters and /or localised clean soil/sandbag bunding prior to commissioning of the tank.

A location plan and photographs of the tank are included in **Appendix 2**.

3.3 Site Wide Environmental Quality Monitoring Set Up

The MPP deployment included details of the site environmental quality monitoring to be undertaken during the remediation works. These include regular real time monitoring of volatiles using a handheld PID around all working and treatment and segregation areas, as well as monitoring of dust, noise, vibration and odours from 6 locations around the site boundary. In addition, Tenex tubes, which record VOC averages over 2-week periods were installed at 4 locations around the site boundary and treatments areas.

A drawing showing the location of the environmental monitoring points is included in **Appendix 2**.

DRAFT

4.0 ADDITIONAL GROUND INVESTIGATION WORKS

4.1 2019 Delineation Investigation

In accordance with recommendations in Section 4.5 of the Remediation Scheme for Contamination, additional ground investigation works were undertaken to investigate and better define existing shallow soil and groundwater contamination beneath Area A/Plume 1 and Area D/Plume 3 in the north of the site.

Ground investigation works were undertaken by Buckingham Group Contracting Ltd supported by an experienced engineer between 27th and 30th August 2019 and comprised the following:

- 20No. mechanically excavated trial pits;
- Logging and description of soil samples and groundwater/free phase conditions.
- Retrieval of 34No.representative soil samples and subsequent contamination analysis at a UKAS/MCERTS laboratory
- Retrieval of 22 site wide and plume specific groundwater samples and subsequent contamination analysis at a UKAS/MCERTS laboratory

Trial pits and Groundwater sampling are summarised in the following Tables:

Table 1 Trial Pits and Rationale

Area	Original Location	Rationale for additional Trial pits	Additional GI Locations
Plume 1	BHAN10	Solvent odour, blue staining, and paint tins 0.3 – 0.5m	TP010A (6m north)
	GM01	Thick viscose free phase	TP216A (7m south) TP216B (8m north)
	BHAN216	TPH =8175mg/kg 1.7m	
	BHAN12	TPH = 6780mg/kg at 0.30m, staining and HC odour 1.1-1.8m	
	BHAN214	Benzene>1.8mg/kg 2.0m Odour and staining 0.18-4.25m	TP214A (10m east)
Plume 3	BHAN207	Benzene = 80.1mg/kg 2.1m Toluene = 518mg/kg 2.1m TPH = 6392mg/kg 2.1m Staining, odour and free phase	TP207A (5m west) TP207B (18m west) TP207C (6m north) TP207D (8m east) TP207E (8m south)
	BHAN203	Plume 3 western extent of BHAN207 contamination	TP203A (5m east)
	BHAN04	TPH = 7320mg/kg 1.0-1.2m Buried paint tins and solvent odour	TP04A (6m west) TP04B (6m east) TP04C (8m south)
	BHAN202	Buried paint tins , staining and odour	TP202A (8m west) TP202B (6m east) TP202C (9m north)
	BHAN208	Hydrocarbon odour and staining	TP208A (6m north)
	BHAN206	Hydrocarbon odour and staining	TP206A (5m east) TP206B (8m west) TP206C (8m north)
	GM115	Plume 3, western extent of BHAN206 contamination	TP115A (10m west)

Table 2 Additional GI Groundwater Monitoring

Boreholes	Rationale	Monitoring Suite
BHAN10, BHAN18, BHAN20, BHAN29, BHAN209, BHAN210, BHAN220, BHAN221, BHAN222	Site wide groundwater quality	pH, sulphate (as SO_4), nitrate (as N and NO_3), dissolved oxygen

Boreholes	Rationale	Monitoring Suite
BHAN03, BHAN216, BHAN35	Plume 1	Metals(B, Fe, Mn, as, br, b, be, cd,cr,cu,pb,hg,ni,se,vn,zn) BTEX, speciated TPH, speciated PAH, VOC, SVOC, alcohols
BHAN211, BHAN212, BHAN24	Plume 2	
BHAN5, GM115, BHAN14, BHAN206	Plume 3	
GM104, GM105, GM106	Plume 4	

Results from the ground investigation identified significant buried waste comprising partially filled 44-gallon drums, paint tins and other containers and associated free phase hydrocarbon spatially located on the core of dissolved phase Plume 3. Delineation works around Plume 1 in Tank Farm A also encountered significant shallow contamination, with free phase hydrocarbons and buried waste materials.

A report detailing the findings of the 2019 ground investigation works and groundwater testing is included in **Appendix 3**.

4.2 2020 Infill Boreholes and Rationale

In accordance with recommendations in the Remediation Scheme for Contamination, the following additional site wide boreholes were installed to complete coverage of the site and to provide additional groundwater quality monitoring locations.

Table 3 Infill Boreholes

Borehole	Rationale
BH401	North of the former Drum Park to infill site coverage
BH402	East of the former Drum Park to infill site coverage
BH403	In former Tin Store/Paint Manufacturing Building to infill site coverage
BH404	New site wide monitoring borehole, down gradient in mid-section of PRB
BH405	Adjacent to former Canteen building to infill site coverage
BH406	New site wide monitoring borehole, down gradient of western end of PRB
BH601	New site wide monitoring borehole, down gradient of eastern side of PRB

Analytical testing of soil samples from the boreholes did not detect any contaminant concentrations in excess of the site criteria. Following installation all 400 series boreholes were sampled in March 2020 using low flow sampling techniques and tested for the following analytical suite:

- Speciated TPH
- BTEX
- Speciated PAH
- CLEA Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc)
- pH
- Ammoniacal Nitrogen and Nitrate, Redox, sulphate, Fe(II), Mn(II), TOC/DOC, DO, EC
- VOC
- SVOC

Results were generally of a low order of magnitude for the tested determinants and did not detect any additional areas of contamination.

Locations of the Infill boreholes, logs and soil testing results are included in **Appendix 3**. Monthly monitoring from the new site wide monitoring boreholes is discussed in detail in **Section 12** of this report.

4.3 Radiological Legacy Assessment

Historical records state that radioactive tracer pellets were briefly used to document mixing rates within two paint batching plants in former buildings 190 and 131.

To determine whether any potential remained for a radioactive legacy a review of site archives was undertaken by former AkzoNobel decommissioning manager, Phil Raby who was employed on a consultancy basis for Buckingham Group Contracting Ltd.

Phil advised that radioactive tracer used was Bromine 82 (para dibromobenzene) which was "dissolved in toluene and then injected into the main monomer feed line on both K37 (the Latex Reactor Stream in Bldg.190) and ST14 a Pilot Plant Reactor in Bldg.131". Documentation review also stated that all mixing streams and isotopes were contained within the relevant plant, and that the relevant plant and feeder pipework were decommissioned after the exercise was completed.

The published half life for Bromine 82 is 1.47 days and as such, any bromine-82 used would have completely decayed in approx.30 days.

As such it is concluded that there is no potential for any radioactive legacy from these works, and that no additional works are required.

Copies of the relevant correspondences and the Bromine-82 Fact Sheet are included in **Appendix 3**.

DRAFT

5.0 FREE PHASE ABSTRACTION

A total of 50No. free phase accumulation sumps were installed in Plume 1 (5 sumps) and Plume 3 (45 sumps) over September - November 2019.

Installation of the sumps comprised excavation to minimum 0.5 – 1.0m below standing water level and placement of 900mm diameter twin walled plastic tubes cut with minimum 5mm width slots at offset 400 – 470mm spacings around the circumference. Once placed the surrounding void was backfilled with clean imported stone and a steel grid safety cover wired onto the opening. Skimming sumps were installed on a nominal 20m x 20m spacing over the areas where delineation ground investigations encountered the thickest accumulation of floating free phase. Locations of the sumps is shown in **Appendix 5**.

Following installation, the accumulated free phase was removed on a regular basis using a tractor mounted bowser. In order to avoid depression of the existing groundwater levels in the wells and avoid producing a smear zone of hydrocarbon within the gravel response zone, the abstraction was targeted solely on the floating free phase hydrocarbon, with the abstraction of any underlying groundwater kept to an absolute minimum. A detailed Method Statement for the free phase abstraction is included in **Appendix 5**.

Skimming of the wells commenced on the 18th November 2019 and was initially undertaken on an ongoing rotational daily basis, which reduced to every second day to twice weekly depending on the time taken for levels to recover. Due to the high viscosity of the free phase at many locations, the oil : water interface meter was not particularly accurate at recording thickness of free phase. As such the operator was provided with a dated spreadsheet listing each location with the following options to tick before the skimming starts:

- 1: Clear (no evidence of oil)
- 2: Rainbow sheen
- 3: Sheen and floating blebs of free phase
- 4: Continuous free phase on water surface (5 – 10mm)
- 5: Thick free phase on water surface (>10mm)
- 6: Very thick viscous tarry oil (>10mm)

All liquids recovered by the tractor bowser was transferred directly to a 33,000l green tank bunded tank for subsequent classification testing and offsite disposal in accordance with Duty of Care as detailed in **Section 11** of this report. Over the course of the remediation period a total of 24No. 1,800l loads of free phase and associated impacted groundwater have been recovered and removed from site.

Skimming of free phase continued throughout 2020 until recorded free phase levels were reduced to a non-rebounding sheen (corresponding to categories 1, 2 and 3) for a period of 3 months at all locations, after which all abstraction sumps were decommissioned, and the excavations backfilled with clean site generated 6F2.

A drawing showing the location of the abstraction wells, a Method Statement for the free phase abstraction and a summary graphic of the skimming results over time are included in **Appendix 4**.

6.0 INSTALLATION OF THE PERMEABLE REACTIVE BARRIER

Installation of the co-injected Petrofix and ORC permeable reactive barrier (PRB) commenced in the North-east of the site (Plume 3 area) in May 2020 and was completed by early August 2020 except for a 10 – 15m gap on the Cadent site boundary, where work was required to accurately identify the line of retained gas services to allow this final section of the barrier to be installed. This section was completed in late October 2020. In this area a 1.5m offset was required either side of the live gas, resulting in a 4m gap in the PRB. To account for this, the designed volumes of Petrofix and ORC were doubled, and the co-injected water increased in the locations to the north of south of the 4m gap to ensure both sufficient reagent volume and dispersity to cover the gap.

Following pre-application consultation with the Environment Agency in early 2020 the line of the PRB was extended north along the north-eastern boundary of the site parallel to the culverted course of the Dachett Brook. The PRB was installed in the Plume 3 area of the site first to ensure that a downgradient barrier was present prior to commencement of the targeted remediation works and associated ground and groundwater disturbance in this area of the site. A 4m offset from the southern boundary of the Plume 3 area to the Cadent Site was required due to the presence of the retained live gas mains along this boundary.

Product was introduced into the sub-surface via direct push injection along a series of offset 3m (ORC) and 2m (Petrofix) spaced injection points. The direct push rig drilled to the base of the Taplow Gravels (at an average depth of 7m) and the product was introduced over a 4m horizon (i.e., from the base of Taplow Gravels to standing water level) as the rod was withdrawn.

The Petrofix dose rate per injection point was 20kg/m at a dilution rate of 175/l/m and the ORC Advanced application rate was 36 kg per injection point diluted with 150l of water.

Following completion of the sections along the eastern and southern boundaries of the Plume 3 area the PRB was installed progressively down the eastern boundary with the Cadent site, and along the east – west access road between the industrial/commercial and residential phases of the site.

Details of the Permeable Reactive Barrier including an as build drawing of all injection points and injection design details are included in **Appendix 5**.

DRAFT

7.0 SOIL REMEDIATION AND VALIDATION

Delineated hotspots were excavated under the supervision of the geo-environmental specialist with a PID detector. Hotspots were excavated initially to the surrounding lateral compliant validation points, with further excavation at the discretion of the geo-environmental specialist based on visual/olfactory evidence and PID readings. Excavations were extended vertically to the base of the unsaturated zone prior to validation samples being obtained by the geo-environmental specialist. Samples were taken either directly into glass jars or vials or using a stainless-steel trowel which was cleaned between sampling points and placed in a cool box for transfer to i2 Analytical (UKAS/MCERTS accredited) for analysis. Samples were scheduled for the failed determinants (generally BTEX and /or speciated PAH) Samples were obtained from the walls and base of the excavations in accordance with the following table:

Table 4 Validation Sampling Frequency

Situation	During excavation	At the edge of excavations	At the base of excavations
Excavation of contaminated soil	1 per 500m^3	1 per 10m length 1 per 1m depth	10m grid

Results from the validation testing have been assessed against the Appendix D1 Site Acceptance Criteria (SSAC) from the BGCL Remediation Scheme for Contamination

Remediation delineation and excavation works in the core of Plume 3 (Zone 1) and beneath the former concrete slab in Plume 1/Tank Farm A (Zone 3) encountered significant deposits of buried waste comprising partially filled metal and wooden drums, partially filled with oils and resins, smaller metal drum and paint tins with relic fluids and pigments, oily rags and fabric and wood waste. Although confined to the unsaturated zone, these burial pits contained significant volumes of associated free phase hydrocarbons and contaminated perched groundwater.

As such all excavations in these areas were undertaken with the support of the free phase skimming tractor bowser, which would recover all contaminated liquids as the remediation excavations progressed. All recovered free phase and contaminated perched waters were then transported directly to the 33,000l green tank for subsequent classification testing and offsite disposal in accordance with Duty of Care.

During excavation of impacted soils and extraneous waste materials the excavator was supported by a second machine with a mechanical grabber. As the buried drums and associated waste were exposed, the grabber selectively removed large drums and containers, allowing the contents to drain into base of the excavation where they were immediately recovered by the tractor bowser. The recovered drums and containers were then temporarily placed in opened topped steel tanks adjacent to the excavation to allow further drainage before being transferred to the bunded quarantine and treatment pads in the MPP area for further treatment as detailed in **Section 9.0** of this report.

All liquids accumulating in the base of the containers were recovered by the tractor bowser to the 33,000l green tank for subsequent classification testing and offsite disposal in accordance with Duty of Care.

Extraneous materials such as wood and fabric were also recovered by the grabber and placed in a separate open topped tank for subsequent further segregation and classification in the MPP area.

Following recovery of free phase hydrocarbons and initial segregation of extraneous materials , surrounded grossly impacted soils were excavated and loaded directly onto dumpers for transfer to one of the bunded bioremediation MPP treatment areas and placed in windrows for ex-situ bioremediation as detailed in **Section 9.0**. Dumpers were underfilled to avoid spillage of contaminated soils during transfer.

7.1 Tank Farm A/Plume 1 Area

Soil hotspot BTEX and TPH excavation commenced in the Plume 1 area in late August 2021 following removal of the former concrete tank farm base. Significant volumes of buried waste drums, tins and fabric and associated free phase were encountered within the Made Ground to a maximum depth of 2.0m below the base of the slab, with the top of the underlying Taplow Gravels also displaying visual and olfactory evidence of contamination. Extraneous materials, free phase and contaminated soils were excavated as described in **Section 7.0** above. Remediation works in this area were essentially completed by early September 2020 with the exception of a small area of buried tins and drums around the installation of monitoring borehole BHAH216, where the presence of a live water hydrant precluded access. This remaining area was remediated in December 2020.

Excavated extraneous materials were segregated in the MPP area, and impacted soils were transferred to windrows WRi/j, WRi2, WRi3, WRi4, WRi5 and WRi6 for treatment and subsequent reuse as detailed **Section 9.0** and **10** of this report.

A total of 39 validation samples were obtained and submitted to the project laboratory for speciated TPH and BTEX testing as detailed in the following Table:

Table 5: Plume 1/Tank Farm A Hotspot Validation

Hotspot	Depth (m)	**Validation Samples**	**Lab Reports**	**Comment**
Plume 1	1 - 2	BHAN216/V1 - V39	20-21877-1 20-24526-1 20-26190-1 20-27573-1	All samples compliant with remediation SSAC with exception of V11

All samples were compliant with the SSAC with the exception of sample V11 which contained a total TPH concentration of 6200mg/kg compared to the SSAC of 5000mg/kg. Sample V11 was located in the southern centre of the remediation void at a depth of 2.6m. This area was re-excavated and a further sample taken at 2.7m. Whilst the TPH criteria for this sample was compliant, the associated benzene concentration of 0.180mg/kg was in excess of the benzene SSAC of 0.033mg/kg. This deeper sample was located just below the limit of unsaturated zone remediation depth, with groundwater ingress into the deeper sample excavation into the natural sands and gravels precluding any deeper excavation.

As such the remediation void was partially backfilled using bioremediated materials from the MPP area as detailed in **Section 10.0** to allow commencement of the targeted RRC injection works.

In total an aggregate volume of 970m^3 of extraneous material and impacted soils were recovered from the Plume 1/Tank Farm A void. As built surveys of all remediation voids and validation sample locations and copies of all relevant validation sample laboratory report sheets are included in **Appendix 6**.

7.2 Plume 2 Area

Remediation of unsaturated zone contamination around Plume 2 was undertaken between late August and early September 2021, centred on an elevated TPH concentration in shallow Made Ground in borehole BHAN212.

Contamination encountered during the excavation was observed to be highly localised staining and malodourous ground immediately adjacent to a former, now redundant drain, with no evidence of contamination observed in the surrounding Made Ground or natural sands and gravels. As such, the remediation works comprised localised tracing and removal of visually impacted Made Ground along the length of the drain.

Circa 90m^3 of material was excavated, of which approximately 20m^3 exhibited visual and olfactory evidence of gross contamination and was transferred to windrow WRN in the bioremediation treatment area. The remaining 70m^3 of arisings was tested and found to be compliant with the SSAC.

Following excavation validation samples were obtained as detailed in the following table:

Table 6: Plume 2 Hotspot Validation

Hotspot	Depth (m)	**Validation Samples**	**Lab Reports**	**Comment**
Plume 2	1.4 – 2.1	BHAN212/V1 - V12	20-27619-1 20-28443-1	Final samples compliant with remediation SSAC

All samples were compliant with the SSAC with the exception of sample BHAN212/V2, which contained a benzene concentration of 0.037mg/kg compared to a SSAC of 0.033mg/kg. This area was further excavated, and a subsequent sample (BHAN212/V2A) obtained. This sample was compliant with the 0.033mg/kg SSAC and as such the void was backfilled with suitable material including the compliant BHAN212 arisings as detailed in **Section 9.0** and **10** of this report.

As built surveys of all remediation voids and validation sample locations and copies of all relevant validation sample laboratory report sheets are included in **Appendix 6**.

7.3 Plume 3 Area

Hotspot excavation works commenced in the Plume 3 area in June 2020 following completion of the downgradient section of the PRB and were completed early September 2020.

Significant volumes of buried waste drums, tins and fabric and associated free phase were encountered within the Made Ground around BHAN207 to a maximum depth of 2.7m below the base of the slab, with the top of the underlying Taplow Gravels also displaying visual and olfactory evidence of contamination. In this area an aggregate total of 1,200m^3 of extraneous materials and impacted soils were excavated, with a further 700m^3 of hydrocarbon impacted soils being excavated from GI defined hotspots around BHAN209, BHAN04, BHAN208 and BHAN206.

Free phase hydrocarbons and contaminated perched groundwater was recovered during the excavation work via the tractor bowser to the 13,000l green tank and excavated extraneous materials were segregated in the MPP area. Impacted soils were transferred to windrows in the MPP area for treatment and subsequent reuse as detailed **Section 9.0** and **10** of this report.

Following remediation excavation validation samples were obtained and submitted to the project laboratory for speciated TPH and BTEX testing as detailed in the following Table:

Table 7: Plume 3 Hotspot Validation

Hotspot	Depth (m)	**Validation Samples**	**Lab Reports**	**Comment**
BHAN04	1.0 -1.5	BHAN204/V1 – V10	20-15130-1	Final samples all compliant with remediation SSAC
BHAN209	2.0 – 2.5	BHAN209/V1 – V15	20-16517-1	
BHAN208	2.0	BHAN208/V1 – V8	20-17049-1	
BHAN206	1.6 – 2.0	BHAN206/V1 – V7	20-17051-1	
BHAN207	2.0 – 2.7	BHAN207/V1 – V28	20-21548-1 20-23347-1 20-23651-1 20-28443-1 20-27568-1	
BHAN207 East	2.0	BHAN207East/V1 – V10	20 - 24134-1	

BHAN207 remediation void validation samples V1, V2,V14, V15, V16, V17, V18 (Report Reference 20-21548-1) and V25 (report reference 20-23347-1) contained exceeded of the site SSAC for benzene so further material was excavated and samples V1a, V2a,V14a, V15a, V16a, V17a, V18a (Report reference 20-23651-1) and V25a (report Reference 20-27568-1) were obtained and retested.

All retests were compliant with the exception of V2A and V25a. The excavation was further extended at this location and samples V2B and V25B retrieved. These samples (Report reference 20-27568-1 and 20-28443-1) were all compliant with the SSAC and as such the void was backfilled with compliant materials from the MPP area as detailed in **Section 10.0**.

As built surveys of all remediation voids and validation sample locations, progress photos and copies of all relevant validation sample laboratory report sheets are included in **Appendix 6**.

7.4 Asbestos Area

During ground proving works low levels of asbestos fibres in soils and fragments of visible ACM comprising asbestos cement and asbestos rope were encountered in the northeast of the Plume 3 area in the vicinity of former borehole BHAN202.

This area was excavated under the supervision of BGCL Category B Asbestos trained site operatives with the support of an independent air quality analyst. Materials were progressively excavated and handpicked under active dust suppression, with any ACMs encountered being placed into asbestos bags, which are double bagged and sealed with duct tape using the swan neck technique. The asbestos bags are then placed into an open 40-yard skip, for subsequent offsite disposal.

Following handpicking the material was transferred to the MPP treatment area and placed in segregated stockpiles for further picking and recovery of ACMs before further testing to ascertain suitability for retention on site. All operations in the MPP area were undertaken by Category B Asbestos trained site operatives, supported by the air quality analyst under active dust suppression. A volume of approximately 1,200m^3 of material was excavated from the asbestos area to the MPP area to the following treatment stockpiles in the MPP area:

- WRM3
- WRM4
- BTA1 ASBESTOS 2
- BTA2 ASBESTOS 2

Following removal of the ACM impacted verification samples were obtained from the sides of the excavation to confirm removal of all contaminated materials as summarised below:

Table 8: Asbestos Void Validation

Hotspot	Depth (m)	**Validation Samples**	**Lab Reports**	**Comment**
BHAN202 Asbestos Area	0.80	AVV1 – AVV5	20-38050-1	Compliant with remediation SSAC
	1.0	AVV6 – AVV11	20-14203-1	
	1.0	AVV12 – AVV13	20-43135-1	

The remediated asbestos void was then backfilled with compliant materials from the MPP area as detailed in **Section 10.0**.

As built surveys of all remediation voids and validation sample locations, progress photos and copies of all relevant validation sample laboratory report sheets are included in **Appendix 6**.

7.5 Site-Wide Ground Proving

Following demolition of buildings, slab removal and completion of remediation works as detailed above all exposed ground was mechanically proven to a depth of 2m and any encountered obstructions removed. All the ground proving works were undertaken under a watching brief by the geo-environmental specialist with a PID and any suspicious or extraneous materials were segregated out and transferred to the MPP area for compliance testing and treatment as required . Details of the treatment and reuse of these materials are detailed in **Section 9.0** and **10** of this report.

Ground proving works have yet to be completed in the following areas of the site:

- Along the north-western canal side edge of Zone 2
- Beneath the currently undemolished Building 173 and surrounding road in the northwest of Zone 3
- Beneath the currently undemolished Building 107 in Zone 5

Ground proving in these areas will be supervised by the geo-environmental specialist as detailed above and any encountered extraneous and/or contaminated materials encountered will be brought to the attention the Local Authority and an addendum report issued to detail any actions taken.

DRAFT

8.0 DISSOLVED PHASE TREATMENT

8.1 Plumes 3 ORC Injection

Following installation of the PRB along the eastern and southern edges of the Plume 3 area and remediation of unsaturated soil contamination as detailed in sections 6.0 and 7.0, dissolved phase contamination in the core of Plume 3 was treated via a campaign of Oxygen Release Compound (ORC -Advanced) direct push injection to provide a controlled release of oxygen and facilitate the aerobic degradation of residual dissolved phase BTEX and TPH in the groundwater in the Taplow Gravel aquifer.

ORC injection treatment commenced in the southern end of Plume 3 on Thursday 29th July 2020 and was completed on 16th of October 2020. ORC was injected on a 3m x 4m spacing centred on the core of Plume 3 from the main source area in the remediated burial pits around borehole BHAN207 and over the downgradient extent of the plume to the PRB on the southern boundary with the Cadent Site.

ORC was introduced via direct push injection on a 3m by 4m spacing. The direct push rig drilled to the base of the Taplow Gravels (at an average depth of 7m) and the product was introduced over a 4m horizon (i.e., from the base of Taplow Gravels to standing water level) as the rod was withdrawn.

The ORC Advanced application rate was 36 kg per injection point diluted with 150l of water. Including the 3m spaced ORC component of the Cadent Boundary PRB a total of 225 injection points for an aggregate total ORC Advanced mass of 8,100kg were injected into the Plume 3 core.

A drawing showing all Plume 3 injection locations is included in **Appendix 7**. Pre and post-treatment groundwater contaminant concentration trends are discussed in detail in **Section 12** of this report.

8.2 BHAN17 RegenOx Injection

Localised injection of RegenOx was undertaken in an area of intermittently elevated dissolved phase chlorinated solvent in the groundwater around boreholes BHAN17nand BH5 to facilitate degradation through enhanced chemical oxidation. These works were carried over three campaigns on a nominal 4m x 4m spacing, staggered slightly to avoid the retained foul sewer and associated standoff area.

The RegenOx Part A and Part B was mixed in the grout pan of the direct push rig at an application rate of 48.2kg and 36.2kg respectively and 1,150l water per location. The direct push rig drilled to the base of the Taplow Gravels (at an average depth of 7m) and the product was introduced over a 4m horizon (i.e., from the base of Taplow Gravels to standing water level) as the rod was withdrawn.

The first round of RegenOx injection treatment commenced on the 6th of August with the second round on the 3rd of September. The third and final round of the RegenOx injection began on the 29th of September and finished on the 8th of October 2020.

A drawing showing all RegenOx injection locations is included in **Appendix 7**. Pre and post treatment groundwater contaminant concentration trends are discussed in detail in **Section 12** of this report.

8.3 Plume 1 ORC Injection

Following completion of the free phase skimming and remediation of unsaturated contaminated soils in the Tank Farm A area dissolved phase contamination in the core of Plume 1 was treated via a campaign of Oxygen Release Compound (ORC -Advanced) direct push injection to provide a controlled release of oxygen and facilitate the aerobic degradation of residual dissolved phase BTEX and TPH in the groundwater in the Taplow Gravel aquifer.

ORC injection treatment commenced in Plume on 19th of October and was completed on 26th of October. ORC was introduced via direct push injection on a 3m by 4m spacing. The direct push rig drilled to the base of the Taplow Gravels (at an average depth of 7m) and the product was introduced

over a 4m horizon (i.e., from the base of Taplow Gravels to standing water level) as the rod was withdrawn.

The ORC Advanced application rate was 36 kg per injection point diluted with 150l of water. Including the 3m spaced ORC component of the Cadent Boundary PRB a total of 31 injection points and an aggregate total ORC Advanced mass of 1,116kg were injected into Plume 2.

A drawing showing all Plume 1 injection locations is included in **Appendix 7**. Pre and post-treatment groundwater contaminant concentration trends are discussed in detail in **Section 12** of this report.

DRAFT

9.0 SCREENING AND BIOREMEDIATION OF IMPACTED SOILS

Excavated soils from the remediation voids were placed in segregated and signposted stockpiles in the MPP areas for treatment . Treatment included regular turning of hydrocarbon impacted soil stockpiles to oxygenate the material and promote aerobic bio-degradation, as well as physical screening and picking of extraneous materials .

Two mechanical mobile soil screening units were operating on in the MPP areas, one with a 75mm mesh)and the other with a 25mm mesh. The screeners remove any extraneous material from the soils as well as breaking up and aerating the soils, increasing the likelihood of volatilisation of any hydrocarbons present. Moisture content modification with lime was used as required to facilitate the screening process.

The oversize stream was processed using a Buckingham excavator with a magnet attachment, to remove any ferrous metal, followed by manual handpicking to create separate waste streams, wood, rags and paint cans for subsequent classification testing and offsite disposal.

The separated fines are then placed into windrows, which are turned at a minimum frequency of twice weekly to increase oxygenation and promote biological degradation of elevated contaminants. Regular surveys of the MPP areas and stockpiles were undertaken for the duration of the treatment period to ensure all materials streams were tracked from source, through the treatment process to reuse or offsite disposal.

All windrows in the MPP areas were tested at a minimum frequency of 1 sample per 250m^3 during the treatment period to demonstrate compliance with the site reuse SSAC as summarised in the following table:

Table 9 Soil Bioremediation and Treatment Windrows

Windrow	Source	Volume (m3)	Sample References	Lab Reports	Comment
Skimming Sump Arisings	Excavation of skimming sumps	1300	SPA1 – 8	19-68233-1 20-97259-1 20-15471-1	Compliant with Remediation SSAC
Windrow A	BHAN04	96	WRA/1 – 3	20-17043-1 20-19287-1	Compliant with Remediation SSAC
Windrow B	BHAN209	241	WRB/1 – 3	20-17043-1 20-19287-1	Compliant with Remediation SSAC
Windrow C	BHAN209	192	WRC/1 – 3	20-17043-1 20-19287-1	Compliant with Remediation SSAC
Windrow D	BHAN208	92.5	WRD/1 – 3	20-17969-1 20-19814-1	Compliant with Remediation SSAC
Windrow E	Proofing arisings near BHAN202	118	WRE/1 -3	20-17969-1 20-19814-1	Compliant with Remediation SSAC
Windrow FH	Proofing arisings near BHAN224 & BHAN17	44.2	WRFH/1 & 2	20-21875-1	Compliant with Remediation SSAC
Windrow iJ	Plume 1	155	WRiJ/1 – 3	20-22887-1 20-28061-1	Final samples compliant with remediation SAAC
Windrow G	BHAN207	190	WRF1 – 4	20-19286-1 20-21553-1 20-28061-1	Final samples compliant with remediation SAAC
Windrow i2	Plume 1	150	WRi2/1 – 3	20-25043-1 20-28061-1	Final samples compliant with remediation SAAC
Windrow i3	Plume 1	71	WRi3/1 – 3	20-25043-1 20-28061-1	Compliant with Remediation SSAC
Windrow i4	Plume 1	75	WRi4/1 – 2	20-28061-1 20-30005-1	Compliant with Remediation SSAC
Windrow i5	Plume 1	99	WRi5/1 – 5	20-30005-1 20-30574-1	Final samples compliant with remediation SAAC

Windrow	Source	Volume (m3)	Sample References	Lab Reports	Comment
				20-35859-1	
Windrow i6	Plume 1	20	WRi6/1	21-49648-1	Compliant with Remediation SSAC
Windrow K	Proofing arisings for RegenOx area	155	WRK/1 - 4	20-23657-1 20-26188-1	Compliant with Remediation SSAC
Windrow L	BHAN207 East	61	WRL/1 – 2	20-26055-1 20-28061-1	Compliant with Remediation SSAC
Windrow M	Proofing arisings in Zone 1	73	WRM/1 – 2	20-28061-1 20-30005-1	Compliant with Remediation SSAC
Windrow M2		85	WRM2/1	20-30005-1	Compliant with Remediation SSAC
Windrow M3		480	WRM3/1 -2	20-30574-1	Compliant with Remediation SSAC
Windrow MP4		218	WRM4/1 - 2	20-33984-1 20-44487-1	Compliant with Remediation SSAC
Windrow WRP	Arisings recovered following screening oversize	18	WRP1- 2	20-30574-1 20-44487-1	Compliant with Remediation SSAC
Windrow M5	Proofing arisings in Zone 1	38	WRM5/1	20-35860-1	Compliant wit Remediation SSAC
Windrow M6		28	WRM6/1 – 2	21-51527-1	Non-compliant benzene *further testing pending*
Windrow M7		14	WRM7/1	21-51527-1	Compliant with Remediation SSAC
Windrow M8		33	WRM8/1	21-53436-1	Non-compliant with asbestos Remediation SSAC *further handpicking pending*
Windrow NO	BHAN212 & 207 & 207East arisings	27	WRN/1,WRO/1, WRNO/1	20-28761-1 20-28761-1 20-31332-1	Compliant with Remediation SSAC
Windrow Q	Screen fines from segregated oversize	86	WRQ, WRQ2 – 4	20-43090-1 21-49646-1 21-52630-1	Final samples compliant with remediation SAAC
BTA1_Asbestos	Proofing arisings in Zone 1 and asbestos void	30	BTA1 ASBESTOS	20-28059-1, 20-26054-1, 20-28106-1	Compliant with Remediation SSAC
BTA2 Asbestos		108	BTA2 ASBESTOS	20-26054-1, 20-28446-1	Compliant with Remediation SSAC
BTA1 Asbestos 2		250	BTA1 ASBESTOS 2, BTA1 ASBESTOS 2A, BTA1 ASBESTOS 2B	20-33984-1, 20-42019-1, 20-38048-1, 20-43529-1	Compliant with Remediation SSAC
BTA2 Asbestos 2		239	BTA2 ASBESTOS 2, BTA2 ASBESTOS 3, BTA2 ASBESTOS 2A, BTA2 ASBESTOS 2B	20-33984-1, 20-42019-1, 20-38048-1, 20-43529-1	Compliant with Remediation SSAC
BTA1 Asbestos 3	Proofing arisings in Zone 4	10	BTA1 ASBESTOS 3	20-44012-1	Compliant with Remediation

Photos of the screening and bioremediation procedures, stockpile tracking drawing, summary testing tables and hardcopy analytical testing results are included in **Appendix 8**.

10.0 REUSE OF SITE GENERATED MATERIALS

Following treatment and compliance testing in the MPP area, compliant material has been reused onsite to backfill remediation voids and excavations. Remediated material was placed in 300 mm layers and was compacted using a smooth drum roller, with vibration. All backfilling was supervised by the on-site Geo-Environmental Engineer to ensure the material being used for backfilling is not too wet.

A summary of the reused site generated material is provided in the following table:

Table 10: Reused Remediated Materials

Source Material	Placement Date	Approximate Volume Placed (m^3)	Placement Location
BHAN206 Arisings	16/07/2020	171	BHAN206 Void
Skimming Sump Arisings	24/08/2020	32	BHAN04 Void
BHAN207 & 207East Arisings	24/08/2020	65	
WRB	24/08/2020 & 26/08/2020	195	BHAN209 Void
WRC	24/08/2020 & 26/08/2020	149	
WRA	25/08/2020 & 26/08/2020	115	
BHAN209 Arisings	27/08/2020	16	BHAN207 East Void
ZONE 1 Arisings	02/09/2020 & 04/09/2020	188	
WRD	05/09/2020	93	
BHAN207 & BHAN207EAST arisings	08/09/2020	137	BHAN207 Void
WRi3	08/09/2020	71	
WRK (FHE)	08/09/2020 & 09/09/2020	209	
WRL	11/09/2020	61	
BHAN212 Arisings	09/09/2020	79	BHAN212 Void
WRG	14/09/2020	190	BHAN216 Void
BTA1 Asbestos	15/09/2020	30	
WRi/J	15/09/2020	155	
WRi4	15/09/2020	75	
BTA2 Asbestos	16/09/2020	108	
WRM	17/09/2020	73	Zone 1 Asbestos Void
WRi2	17/09/2020	150	
WRN & WRO	22/09/2020	27	
SPA8	23/10/2020	222	
WRM2/3	04/11/2020	144	
WRi5	11/11/2020	90	
BTA1 Asbestos 2	11/11/2020	194	
BUND 2	15/02/2021	85	General re-levelling in Zone 1
WRQ	15/02/2021	89	

In total a volume of 3,213m^3 of site won and remediated material has been re-used in the earthworks, predominantly as backfill for the remediation excavations.

All materials movements and reuse of site won materials within the AkzoNobel site have been undertaken in accordance with the independently approved CoP MMP and required specifications. As such, and in accordance with the CL:AIRE CoP MMP, these materials are now considered to be non-waste.

Drawings showing the final placement location of site won/remediated materials and material tracking sheets are included in **Appendix 9**. Source stockpile plans and analytical testing results demonstrating the suitability of the materials for reuse ae included in **Appendix 8**.

At the time of reporting the following stockpiles are still present onsite pending placement.

- Windrow M6 58m^3
- Windrow M7 14m^3
- Windrow M8 33m^3
- BTA2 Asbestos 2 239m^3
- BTA1 Asbestos 3 10m^3

Material from windrows BTA2 Asbestos 2 & 3 and M7 contain asbestos fibre concentrations in excess of the site criteria of <0.001% but less than 0.1%. As such and in accordance with the BGCL Remediation Scheme for Contamination, these materials will be placed at a depth of greater than 1m below finished levels in a designated surveyed location in the Phase 1 or 2 area. The location of the placed material will be covered with a “no-dig” warning geotextile and a minimum of 1m of clean material.

Windrow M6 is pending analytical results due to an initial benzene exceedance and windrow M8 contains an asbestos concentration of 0.618mg/kg and is pending further handpicking and retesting. Subject to compliant results, these materials will be either incorporated into the low-level asbestos repository as detailed above or disposed of to an offsite facility.

The placement and/or offsite disposal of these materials will be documented under an addendum letter report to be issued when the final site earthworks are works are completed:

DRAFT

11.0 OFFSITE DISPOSAL

11.1 Hydrocarbon Contaminated Soils

A total of six loads of hydrocarbon contaminated soils for an aggregate volume of 64m^3 were disposed of to a licenced offsite facility as follows:

Couriers:
FFC
Waste Carrier Licence: CBDU3337

Receiving Facilities:
ERQ Soil Treatment Centre,
Portway Road, Rowley Regis,
B65 9BT
WML/Exemption/ PPC Licence: EPR/HP3632RP

11.2 Waste Tins, Wood, Paint Solids and Rags

A total of 64,000kg loads of mixed paint solids, rags, cans and waste wood recovered from the Plume 1 and Plume 2 burial pits were disposed of to a licenced offsite facility as follows:

Couriers:
Robert Hopkins Environmental Services Ltd
Waste Carrier Licence: CBDU80960

Receiving Facilities:
Robert Hopkins Environmental Services Ltd
Bullock Street,
West Bromwich
B70 7HE
WML/Exemption/ PPC Licence: EPR ZP3537SL

11.3 Asbestos Impacted Soils

A total of 11 8yard skips of asbestos impacted soils and asbestos waste were disposed of to a licenced offsite facility as follows:

Couriers:
FCC
Waste Carrier Licence: CBDU3337 (2 x Loads)

Biogenie
Waste Carrier Licence: CBD113446 (9 x Loads)

Receiving Facilities:
ERQ Soil Treatment Centre,
Portway Road, Rowley Regis,
B65 9BT
WML/Exemption/ PPC Licence: EPR/HP3632RP (2 x loads)

BIFFA Redhill,
Patteson Court, Nutfield Road,
Redhill, RH1 4ER
WML/Exemption/ PPC Licence: EPR/BU8126 (9 x loads)

DRAFT

11.4 Free Phase and Oily Water

A total of 24No. 1,800l loads of free phase and associated impacted groundwater have been recovered and removed from site as follows:

Courier:
Hydro Cleansing Ltd
Waste Carrier Licence: CBD492847

Receiving Facility:

CSG Aylesford,
Mills Lane
Quarry Road Industrial Estate
Aylesford Kent ME20 7NA

WML/Exemption/ PPC Licence: EPR/UP3033UX/V005

Copies of all waste documentation are included in **Appendix 10**.

DRAFT

12.0 MONTHLY GROUNDWATER MONITORING

Groundwater monitoring has been undertaken in general accordance with the BGCL Remediation Scheme for Contamination. A summary of the monitoring undertaken is presented in the following table:

Table 11 Groundwater Monitoring

Monitoring	Boreholes	Frequency	Duration
Site-Wide	*Upgradient of PRB* BHAN10, BHAN220, BHAN29, BHAN210, BHAN18 *Downgradient of PRB* BHAN22, BHAN221, BHAN222, BH404, BH406, BH601	Monthly	*Upgradient of PRB* One month before until eight months after completion of remediation and earthworks *Downgradient of PRB* One month before until eight months after completion of remediation and earthworks, quarterly thereafter for 16 months
Plume 1	BHAN03, BHAN216, BHAN215 and BHAN35	One month before remediation works and at monthly intervals for 8 months*	
Plume 2	BHAN211, BHAN212, BHAN24	One month before remediation works, then monthly	8 months post-remediation works
Plume 3	GM105, GM115, BHAN14, BH206s & d, BH5, BHAN208 & BHAN209	One month before remediation works and at monthly intervals for 8 months*	
Plume 4	GM106, GM104, BHAN218, GM105	One month before remediation works, then monthly	8 months post-remediation works

** The Remediation Scheme for Contamination stated the Plume 1 and Plume 3 were to be monitored fortnightly for the first two months, to coincide with the proposed unsaturated zone remediation and Plume injection works. This was altered to monthly as it was clear once works commenced that the remediation of these areas would take significantly longer than two months to complete.*

To demonstrate betterment the groundwater analytical results have been compared to the following Groundwater Guidance Values from the BGCL Remediation Scheme for Contamination:

Table 12 Groundwater Guidance Values (Plumes and Upgradient of PRB)
(*Source Arcadis DQRA*)

Determinant	Groundwater Guidance Values (mg/l)
TPH Aliphatic >C5 – C6	0.453
Benzene	0.00661
Ethylbenzene	131
Toluene	48.4
Sum Xylene	6.56
Naphthalene	0.497
Trichloroethene	0.049
cis 1,2-dichloroethene	0.278
Vinyl chloride	0.00617
Tert Butyl Alcohol	0.0534
Free Phase Hydrocarbons	Reduce to non-rebounding sheen (<1mm) for 3 months

Table 13 Groundwater Guidance Values (Downgradient of PRB)
(*Source EQS and/or UKDWS*)

Determinant	Groundwater Guidance Values (mg/l)
Benzene	0.001
Ethylbenzene	0.02
Toluene	0.05
Sum Xylene	0.03
Naphthalene	0.002
Trichloroethene	0.01
cis 1,2-dichloroethene	0.05
Vinyl chloride	0.0005
Tert Butyl Alcohol	0.012

To date groundwater sampling has been undertaken on the following dates:

Table 14 Groundwater Monitoring Events

Date	Locations	Rationale
27th August 2019	Plume 1,2,3,4 and sitewide up and down gradient.	Background site monitoring during additional GI
03rd March 2020		Pre commencement of remediation
11th & 14th May 2020		Monthly Remediation
24th June 2020		Monthly Remediation
30th July 2020		Monthly Remediation
26th August 2020		Monthly Remediation
29th & 30th September 2020		1st monthly post-remediation
28th, 29th & 30th October 2020		2nd monthly post-remediation
25th & 26th November 2020		3rd monthly post-remediation
17th December 2020 & 13th January 2021		4th monthly post-remediation

Samples were retrieved using low flow sampling techniques and submitted to the project laboratory i2 Analytical (MCERTS/UKAS) for the following analytical suite:

- arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc
- polycyclic aromatic hydrocarbons (PAH)
- total petroleum hydrocarbons (TPH) with CWG split
- volatile organic compounds(VOCs)
- BTEX
- electrical conductivity, pH
- dissolved oxygen, pH, redox, sulphate, Fe (II), Mn (II), TOC/DOC

A drawing showing locations of all groundwater monitoring boreholes and copies of all groundwater monitoring analytical results and graphs of contaminant of concern trends over time are included in **Appendix 12**.

12.1 Groundwater Levels

Prior to retrieval of groundwater samples, groundwater levels were recorded using an electronic dip meter. Graphs of groundwater levels corrected to mAOD have been produced and are included in **Appendix 11**.

Results show a general sitewide groundwater gradient to the southwest throughout the year. Annual levels display a gradual lowering through the late spring to late summer and rising over the wetter winter

periods. This winter rising trend is exacerbated in late 2020, probably due to increased infiltration following demolition and removal of the widespread hardstanding.

12.2 Groundwater Quality Over Time

Groundwater analyses have been reviewed as results are received and trends relative to the initial monitoring results monitored. Where the quality is stable, concentrations compliant, or contamination trends are decreasing towards the Groundwater Guidance Values, the groundwater quality will be considered satisfactory. While this report has been produced to cover remediation works in the Phase 1 & 2 Commercial areas of the site, assessment of the groundwater quality monitoring results in this section also includes the sitewide boreholes in the Phase 3 Residential area, as these boreholes are located downgradient of the PRB and Phase 1 and 2 remediation works. Additional monitoring of boreholes in the Coal Tar Area within the downgradient Phase 3 residential area are addressed in the Phase 3 Remediation Verification Report.

Groundwater analytical results for selected contaminants recorded over the monitoring period have been graphed to display trends in the dissolved phase contaminant concentrations and water quality indicators over time. This dataset has been augmented by historical testing data from April and August 2018 from the following reports, which were used to inform the BGCL Remediation Scheme for Contamination:

- Arcadis, “AkzoNobel, Slough Manufacturing Unit, Further Environmental Investigation Report”, Dated June 2018
- Arcadis, SMU Groundwater Monitoring Factual Report- Updated, dated 18 September 2018.

12.2.1 Plume 1 Groundwater

Concentrations of BTEX and total TPH display an overall declining trend between the 2018 monitoring event to December 2020, with the concentrations of all determinants with the exception of benzene being between 1 and 4 orders of magnitude below the relevant Groundwater Guidance Value for the duration of the monitoring period. Whilst below their respective targets, increases in the dissolved phase concentrations of naphthalene and toluene were encountered in BHAN216 in the December 2020 monitoring event to maximum concentrations of 0.188mg/l and 0.0623mg/l compared to the RMS targets of 0.497mg/l and 48.4mg/l respectively. These spikes in concentrations are coincident with the remediation excavation of the last pocket of buried paint tins and waste around the borehole installation in mid-December that was delayed due to the proximity of a water hydrant and are expected to decline now that intrusive earthworks in this area have been completed.

Concentrations of dissolved phase benzene remained below the laboratory lower limit of detection and the RMS target concentrations at all locations except for borehole BHAN216, located on the immediately downgradient southwestern edge of Plume 1. Concentrations of benzene at this location increased from <0.001mg/l in May 2020 to a maximum of 0.44mg/l in July 2020, with a subsequent overall downward trend to the most recent concentration of 0.0623mg/l compared to the Groundwater Guidance Value of 0.00661mg/l in December 2020. This temporary spike in concentration corresponds to the initial removal of overlying slabs and remediation excavations beneath the former basal slab of Tank Farm A.

Concentrations of trichloroethene, cis 1,2-dichloroethene and vinyl chloride have remained below the lower laboratory limit of detection for the duration of the monitoring period with the exception of a single TCE and DCE concentration of 0.0137mg/l and 0.0123mg/l respectively from borehole BHAN216 in the December 2020 monitoring event. These >LOD values were well below the relevant Groundwater Guideline Values of 0.049mg/l and 0.278mg/l.

Levels of dissolved oxygen in the monitoring boreholes show an overall increase up to mid-November following completion of the ORC injection works in October 2020. Levels recorded in December 2020 were generally lower than those recorded in November, suggesting that some process in the groundwater is actively utilising the bio-available oxygen. Given the corresponding decreases in

dissolved phase hydrocarbon concentrations discussed above, it is likely that this process is aerobic degradation of the contamination following removal of the unsaturated zone, which previously acted as a continuous replenishing source.

A further 4 monthly post-remediation monitoring vents are scheduled for Plume 1. Given the above results, it is anticipated that groundwater conditions will continue to improve.

Copies of all analytical results and summary graphs for dissolved oxygen and selected contaminants of concern BTEX, total TPH and naphthalene are included in **Appendix 11**.

12.2.2 Plume 2 Groundwater

Unsaturated zone remediation excavations around Plume 2 borehole BHAN212 encountered a limited volume of hydrocarbon impacted soils associated with redundant drainage line which was excavated to the MPP area and validated as documented in **Section 7.3** of this report. Subsequent ground proving to 2m depth in the wider area and upgradient towards the Canal did not identify any further soil contamination within the unsaturated zone, so the source of the elevated groundwater concentrations remains unclear.

Dissolved phase benzene concentrations remain above the RMS target concentration of 0.00661mg/l in boreholes BHAN211 and BHAN212, although concentrations in both boreholes exhibit a declining trend over the duration of the monitoring period.

Monitored concentrations of toluene, ethylbenzene, xylene and naphthalene in boreholes BHAN211 and BHAN212 concentrations have all been below the relevant Groundwater Guidance Values concentrations for the duration of the monitoring period to date, with concentrations in the downgradient borehole BHAN24 being generally below the lower laboratory limit of detection for these determinants.

Concentration trends for total TPH in boreholes BHAN211 exhibit and overall declining trend, however concentrations in BHAN212 show an upward trend to a maximum of 20.2mg/l in September 2020, before dropping to 2.3mg/l, 4.85mg/l and 4.95mg/l in October 2020, November 2020 and January 2021 respectively. This is considered to relate to wider ground disturbance due to demolition, slab removal and remediation earthworks mobilising localised residual soil contamination into the underlying saturated aquifer. Total TPH concentrations in downgradient borehole BHAN24 have been generally below the lower laboratory limit of detection of 0.010mg/l for the majority of the monitoring period and dissolved phase concentrations of the TPH risk driver Aliphatic >C5 – C6 faction have been consistently below the laboratory limit of detection of 0.001mg/l in all the Plume 2 boreholes for the duration of the monitoring period.

Levels of dissolved oxygen in the monitoring boreholes show an overall increase in levels following the localised soil remediation around BHAN212, slab removal and ground proving to 2m depth from late September/early October 2020. The maximum concentration recorded to date was 20mg/l in BHAN211 in October 2020, with the most recently recorded concentrations being 14mg/l, 11mg/l and 9.8mg/l in boreholes BHAN211, BHAN212 and BHAN24 respectively in January 2021. Recorded dissolved oxygen levels suggest that groundwater conditions remain amenable for further aerobic degredation of residual dissolved phase contamination over time. Concentrations of trichloroethene, cis 1,2-dichloroethene, vinyl chloride and tert-butyl alcohol have remained below the lower laboratory limit of detection for the duration of the monitoring period.

Dissolved phase contaminant concentrations in the Plume 2 downgradient monitoring borehole BHAN24 have been consistently below both the Groundwater Guidance Values and the laboratory lower limits of detection for all contaminants of concern for the duration of the monitoring period, indicating that degradation, dilution and attenuation processes are active in the Taplow Gravel aquifer and that the residual contamination in Plume 2 is stable.

A further 4 monthly post-remediation monitoring vents are scheduled for Plume 2. In view of the above results, it is anticipated that groundwater conditions will continue to improve.

Copies of all analytical results, summary graphs for dissolved oxygen and selected contaminants of concern are included in **Appendix 11**.

12.2.3 Plume 3 and Plume 4 Groundwater

Plume 3

The Conceptual Site Model recognises Plume 4 as the downgradient continuation of Plume 3 re-entering the site following migration beneath the adjacent Cadent site and back into the Akzo Nobel Site. As such analytical results from Plumes 3 and 4 are discussed together.

Significant remediation of grossly impacted soils and associated buried hydrocarbon and paint waste was undertaken in the Plume 3 area, followed by a significant campaign of ORC injection as detailed in **Section 7.0** and **8.0** of this report.

Dissolved phase benzene concentrations in the Plume 3 monitoring boreholes, located upgradient of the PRB remain elevated, but display an overall reducing trend over the monitoring period with the exception of BHAN209 and BHAN208, located in the south-eastern edge of the Plume 3 area. Concentrations in BHAN209 increased from <0.001mg/l in October 2020 to 0.0336mg/l in November 2020. This trend appeared to be reversing by 13 January 2021 when the recorded concentration was 0.0301mg/l. Concentrations in BHAN208 rose to a maximum of 0.133mg/l in May 2020, before declining to <0.001mg/l by January 2021.

Benzene concentrations in boreholes BHAN206d and BHAN208 were below the Groundwater Guidance Value of 0.00661mg/l in the most recent monitoring event (January 2021). Elsewhere, benzene concentrations, although declining, remain elevated above the Groundwater Guidance Value, with the most recent concentrations ranging between 0.112mg/l and 0.418mg/l in boreholes GM115 and BHAN206s respectively.

Dissolved phase concentrations of toluene and ethylbenzene were generally below the Groundwater Guidance Values of 48.4mg/l and 131mg/l respectively and exhibit an overall declining trend for the duration of the monitoring period to date.

Xylene concentrations remain elevated above the Groundwater Guidance Value of 6.56mg/l in the majority of the boreholes in Plume 3, however concentrations all display an overall decreasing trend with the exception of borehole BH5 and BHAN208. Xylene concentrations in borehole BH5 show a very slow increase over the monitoring period to a maximum concentration of 37.51mg/l in November 2020 before declining to 0.5194mg/l in January 2021. Dissolved phase xylene concentrations in borehole BHAN208 display a very gradual increase over the monitoring period, although it is noted that all concentrations at this location have remained below the Groundwater Guidance Value by 1 or 2 orders of magnitude.

Further examination of the dataset for these locations suggests that these increasing trends are a function of isolated, temporary, spikes in concentrations which are attributed to ground disturbance and increased infiltration associated with the remediation and general earthworks. It is considered that such spikes will decrease with time given the removal of the soil and free phase contaminant source zones and ORC treatment of the main plume core.

Dissolved phase total TPH concentrations in Plume 3 display a declining trend in all boreholes over the monitoring period with the exception of borehole BH5, which displays a shallow increasing trend due to temporary spikes in concentrations in May and September - November 2020 (to a maximum of 56mg/l). The September to November spike is likely to be related to the RegenOx injection works in this area and reflects desorption of sorbed hydrocarbon contamination following chemical oxidation of the dissolved phase and associated changes to the concentration gradient between the sorbed and dissolved phase. This desorption and temporary increase in dissolved phase concentrations is an anticipated consequence of RegenOx treatment and is followed by a subsequent drop in concentrations as the desorbed dissolved phase is then oxidised in the aquatic environment. This interpretation is

confirmed by the subsequent drop in BH5 Total TPH concentrations to 7.7mg/l by the January 2021 monitoring event.

Concentrations of the TPH risk driver aliphatic >C5 – C6 faction have consistently been below both the lower laboratory limit of detection and relevant Groundwater Guidance Values for the duration of the remediation earthworks and monitoring period in all Plume 3 boreholes.

Concentrations of the PAH indicator species Naphthalene have remained below the Groundwater Guidance Value of 0.497mg/l for the duration of the monitoring period, with levels in the January 2021 event ranging between 0.0142mg/l and 0.176mg/l.

Concentrations of the chlorinated solvent trichloroethene remained below both the Groundwater Guidance Value of 0.049mg/l and the laboratory lower limited of detection of 0.001mg/l at all locations for the duration of the monitoring period. Concentrations of related daughter products cis 1,2-dichloroethene and vinyl chloride, although marginally elevated at some locations in the baseline 2018 dataset have remained below the Groundwater Guidance Values of 0.2787mg/l and 0.00167mg/l in the monitoring boreholes for the duration of the remediation earthworks monitoring period, with the majority of results also below the laboratory lower limited of detection of 0.001mg/l.

Concentrations of all chlorinated solvents in borehole BH5, located immediately down gradient of the BHAN17 RegenOx injection area have also remained below the lower laboratory limit of detection and relevant Groundwater Guidance Values for the duration of the remediation earthworks and monitoring period.

Levels of dissolved oxygen in the monitoring boreholes in Plume 3 show an overall increase in levels following soil remediation and ORC injection works from late May – June 2020. The average recorded dissolved oxygen concentration June 2020 was 2.35mg/l, increasing to a maximum of 8.08mg/l in November 2020 before dropping slightly to 6.26mg/l in January 2021. Recorded dissolved oxygen levels suggest that ORC injection works have produced groundwater conditions amenable for continued aerobic degredation of residual dissolved phase contamination over time.

A further 4 monthly post remediation monitoring events are scheduled for Plume 3. In view of the above results and the remediation of significant contaminant sources from the unsaturated zone, it is anticipated that groundwater conditions within the Plume will continue to improve.

Copies of all analytical results and summary graphs for selected contaminants of concern are included in **Appendix 11**.

Plume 4

The Plume 4 boreholes (GM105, GM104, GM106 and BHAN218) are located at the downgradient end of Plume 3, following migration through the adjacent Cadent site prior to re-entering AkzoNobel. Prior to commencement of soil remediation works in the Plume 3 area the PRB was installed along the Cadent site boundary to afford protection to offsite and down gradient water quality.

Following completion of the PRB, dissolved phase concentrations of BTEX in the Plume 4 boreholes have been below both the lower laboratory limit of detection and the Groundwater Guidance Value since June 2020 with the exception of borehole GM105 where concentrations above the laboratory limit of detection, but not the relevant BTEX Groundwater Guidance Values. Borehole GM105 is the most up gradient borehole in Plume 4, located immediately adjacent to the Cadent site boundary where the Plume re-enters the site. All above detection limit BTEX concentration trends at this location show an overall declining trend over the monitoring period.

Concentrations of total TPH are below the lower laboratory limit of detection over the monitoring period at all locations with the exception of borehole GM105, where concentrations have fluctuated between 0.43mg/l to a maximum of 6.9mg/l. Concentrations of the TPH risk driver aliphatic >C5 – C6 have consistently been below both the lower laboratory limit of detection and relevant Groundwater Guidance Values for the duration of the remediation earthworks and monitoring period at all locations, including

GM105. Concentrations of trichloroethene, cis 1,2-dichloroethene, vinyl chloride and tert-butyl alcohol have remained below the lower laboratory limit of detection for the duration of the monitoring period.

Concentrations of dissolved naphthalene have remained generally an order of magnitude below the Groundwater Guidance Value of 0.497mg/l for the duration of the remediation earthworks and monitoring period at all locations and was below the lower laboratory detection limit of <0.00001mg/l in all locations with the exception of GM105 which recorded a maximum concentration of 0.176mg/l in January 2020. Borehole GM105 is located at the upgradient edge of Plume 4 immediately adjacent to the Cadent site boundary where the downgradient end of Plume 3 re-enters the site. Naphthalene concentrations in the groundwater in borehole BHAN218, located a further 15- 20m downgradient from GM105 have been below the laboratory lower limit of detection of 0.00001mg/l over the last three monitoring events.

Levels of dissolved oxygen in the monitoring boreholes in Plume 4 show an overall increase in levels from an average of 5.75mg/l in May 2020 to a maximum of 8.83mg/l in January 2021.

Results confirm that the upgradient PRB is protecting controlled waters in the Taplow Gravel aquifer downgradient of Plume 3 and that Plume 4 no longer presents any risk to controlled waters. Furthermore, elevated levels of residual dissolved phase contamination in upgradient Plume 3 are expected to continue to degrade over time following removal of the contaminant sources and enhancement of the groundwater conditions through the ORC injection works.

Copies of all analytical results and summary graphs for selected contaminants of concern and dissolved oxygen are included in **Appendix 11**.

12.2.4 Up and Down Gradient Site Wide Groundwater

Upgradient Sitewide Boreholes

Dissolved phase concentrations of toluene, ethylbenzene, xylene, naphthalene, Aliphatic >C5 - C6, trichloroethene, cis 1,2-dichloroethene and vinyl chloride in the upgradient site wide boreholes have remained compliant with the Groundwater Guidance Values for the duration of the monitoring period to date.

Concentrations of benzene over the monitoring period have generally remained below both the lower laboratory limit of detection and the Groundwater Guidance Value with the exception of a single exceedance from borehole BHAN10 in June 2020, and 4 exceedances from borehole BHAN210 in September, October, November 2020 and January 2021.

The isolated exceedance recorded in BHAN10 was 0.0033mg/l compared to the Groundwater Guidance Value of 0.0061mg/l, and all previous and subsequent benzene concentrations from this borehole have been below both the lower laboratory limit of detection and the Groundwater Guidance Value.

The exceedances in borehole BHAN210 were 0.0144mg/l in September 2020, increasing to a maximum of 0.125mg/l in October and decreasing thereafter to 0.0597mg/l, and 0.0545mg/l thereafter.

Borehole BHAN210 is located adjacent to the northern site boundary with the Grand Union Canal and the former above ground latex resin tank farm. Site investigation works and ground proving of this area to 2m depth following demolition of the tank farm did not encounter any visual or olfactory evidence of contamination that may be acting as a source for these exceedances. It is noted that all previous benzene concentrations at this location have been below the laboratory limit of detection, and that the concentrations have been declining since the 0.125mg/l maximum in October 2020 to 0.0545mg/l in January 2021. A similar pattern is seen in total TPH concentrations in borehole BHAN210 with localised spikes in concentrations to 6.6mg/l and 6.0mg/l in the June and September 2020 monitoring events, before declining to 1.1mg/l, 1.2mg/l and 2.1mg/l during the October 2020, November 2020 and January 2021 monitoring events respectively.

It is possible that the results from borehole BHAN210 can be linked to ground disturbance and increased infiltration associated with the demolition and ground proving works in the wider area. Given the absence of any encountered contaminant source in this area of the site it is likely that concentrations will continue to decline.

A further 4 monthly post remediation monitoring events are scheduled for this area of the site.

Downgradient Site-wide Boreholes

Dissolved phase concentrations of the majority of the monitored determinants in the downgradient site-wide boreholes have generally been below both the lower laboratory limit of detection and the EUKDWS/EQS Groundwater Guidance Values for the duration of the monitoring period to date with the exception of the following isolated events.

In the May 2020 monitoring event Xylene concentrations of 1.151mg/l and 0.88mg/l respectively were encountered in boreholes BHAN22 and BHAN406 and naphthalene concentrations of 0.0034mg/l, 0.0023mg/l, 0.015mg/l and 0.00607mg/l were encountered in boreholes BHAN221, BHAN222, BHAN22 and BH406 respectively. All exceedances have returned to below the benzene and naphthalene lower limits of detection in the subsequent June 2020 monitoring visit, with the exception of borehole BHAN22, which recorded a benzene concentration of 0.0422mg/l and a naphthalene concentration of 0.132mg/l. Site works being undertaken in this area of the site and upgradient during this period was limited to demolition of the main buildings, with no intrusive remediation works or injection works along the PRB at the time. As such, these event are likely to be representative of the pre-remediation status of the groundwater quality in the Taplow Gravel aquifer, where generally good quality groundwater experiences occasional low level increases in contaminant concentrations to above the laboratory detection limit.

There were no exceedances of the relevant Groundwater Guidance Values in any of the downgradient monitoring boreholes in the following July, August, September, and October 2020 monitoring events, with the majority of results also being below the lower laboratory limit of detection.

In the November 2020 monitoring event concentrations in excess of the Groundwater Guidance Values were encountered for all BTEX species in boreholes BHAN221, BHAN404 and BHAN406, for Xylene in borehole BHAN22 and for naphthalene in boreholes BHAN22 and BH404. Except for the naphthalene concentration in BHAN404 of 0.0181mg/l, all other exceedances were of the same order of magnitude of the Groundwater Guidance Value. Concentrations of all elevated contaminants had returned to below the lower laboratory detection limit and the Groundwater Guidance Value by the December 2020 monitoring event.

Apart from the temporary level exceedances discussed above, groundwater quality monitoring results have been compliant with the Groundwater Guidance Values for the duration of the remediation and post-remediation monitoring period to date. Results indicate that the upgradient co-injected ORC and PetroFix PRB is providing protection of downgradient water quality from the northern, more contaminated areas of the site.

A further 4 monthly post-remediation monitoring events and 16 months of quarterly monitoring is scheduled for this area of the site and results will continue to be assessed and reported as they are received .

Copies of all analytical results and summary graphs for selected contaminants of concern and dissolved oxygen are included in **Appendix 11**.

12.3 Groundwater Monitoring Summary

Results of the groundwater monitoring undertaken to date display overall declining or stationary concentration trends for the main dissolved phase contaminant of concern. Results confirm that the unsaturated zone remediation earthworks and subsequent targeted groundwater treatment have reduced source contaminant loading and enhanced aerobic degradation amenable conditions within

the saturated zones of the Taplow Gravel aquifer. As a result, ongoing improvement of groundwater quality in these areas is expected to continue.

In view of the degree of ground disturbance and increased infiltration associated with the demolition , remediation and site enabling earthworks it is likely that localised spikes in dissolved phase concentration in the Plume 1, 2 and 3 monitoring boreholes will continue to be detected within the overall declining trends, however these should continue to reduce in frequency and scale over time as residual contamination in the groundwater is no longer being augmented from the now remediated free phase, waste burial pits and unsaturated soil sources.

Results from the downgradient monitoring boreholes are generally compliant with the site groundwater guidance values and confirm that the co-injected ORC and PetroFix permeable reactive barrier is providing ongoing protection of downgradient water quality from the northern Phase 1 and 2 areas of the site. Contaminant of concern concentrations in the down gradient boreholes in Plume 4, the former downgradient extent of Plume 3, have been below the relevant Groundwater Guidance Values since installation of the PRB.

A further 4 monthly post remediation monitoring events in the Phase 1 and 2 plume specific and site-wide boreholes, followed by a further 16 months of quarterly monitoring from the downgradient boreholes in the Phase 3 residential area is scheduled/ Results will continue to be assessed and reported as they are received .

DRAFT

13.0 GROUND GAS MONITORING

Ground gas monitoring events have been carried out on the following dates from the groundwater monitoring boreholes:

Date:	Barometric Pressure (mbar) & 12hr Trend
• 29th September 2020	1011, falling.
• 07th October 2020	1005, falling.
• 14th October 2020	1010, rising.
• 25th November 2020	1008, falling.
• 17th December 2020	1009, steady.
• 03rd February 2021	1001, falling.

Methane concentrations were generally below the instrument detection limit of 0.1% v/v in the majority of boreholes. Concentrations in borehole BHAN03, located on the southern edge of Plume 1 recorded methane concentrations of 28.1% on 29th September 2020 and 18.4% on 17th December 2020, with levels at this location being below detection during the other monitoring events. Elevated methane concentrations of 8.3% v/v, 4.0%v/v and 16.7% v/v were encountered in borehole BHAN210 located adjacent to the Canal side boundary of the site in Zone 2 on 7th October 2020, 14th October 2020 and 03rd January 2020, with all other readings at this location being below the limit of detection.

Elevated concentrations of methane were also encountered in Plume 1 borehole BHAN212 in October, November and December 2020 and January 2021 of 6.8%v/v, 4.6% v/v, 5.7% v/v and 0.9% v/v respectively, as well as a single above detection limit concentration of 7.6% v/v/ in borehole BHAN211 in October 2020. Elevated concentrations of methane were encountered in Plume 3 borehole BHAN216 on 14th October 2020 at 15.6% v/v and borehole BHAN208 on 25th November 2020 with 5.4% v/v. Recorded flows have been generally below detection to negligible over the monitoring period, with the exception of 03rd January 2021 where low positive flow rates of 0.3l/hr and 0.4l/hour were recorded during a falling pressure monitoring event in borehole BHAN10 and BHAN18.

Carbon dioxide concentrations have ranged from below the instrument limit of detection to a maximum of 9.8% v/v/ in borehole GM115 in the downgradient edge of Plume 1. Oxygen levels were depleted in boreholes BHAN03 in Plume 1 which reported a range of 1.0% v/v to 5.8v/v, and BHAN 208 in Plume 3 which recorded a minimum oxygen concentration of 0.2% v/v. Oxygen levels elsewhere ranged from 12 to 22.5% v/v.

Elevated PID concentrations have been encountered in the some of the monitoring boreholes in Plumes 1, 2 and 3 as follows:

Plume 1
BHAN03 12ppm to *off scale*
BHAN216 below detection to 10ppm

Plume 2
BHAN212 1.4ppm to 200ppm

Plume 3
BHAN206 1.5ppm to 270ppm
GM115 4.7ppm to 703ppm
BH5 14ppm to 200ppm
BHAN14 below detection to 40ppm
DSM04 4.8ppm to 200ppm

Results from the ground gas monitoring should be referred to in in the design of gas protection measures in any future development.

Copies of ground gas monitoring results are included in **Appendix 12**.

14.0 ENVIRONMENTAL QUALITYMONITORING

14.1 Vibration Monitoring

Two vibration monitors were deployed on site to monitor vibration levels from demolition and earthworks, and to monitor vibration levels caused by the PRB injection works along the site boundary close to the perimeter Town Gas Main. Vibration levels were generally compliant with the MPP Trigger levels.

Copies of all vibration monitoring events are included in **Appendix 13**.

14.2 Dust Monitoring

Continuous directional dust and PM10 monitoring has been undertaken around the site as detailed under the BGCL MPP. Results have been assessed on a real time basis for the duration of the remediation works to both assess the efficacy and target dust suppression activities. Results have generally been below the MPP Trigger levels.

Copies of all environmental monitoring locations and the directional and PM10 dust monitoring results are included in **Appendix 14**.

14.3 Asbestos Fibre Monitoring

An independent air quality analyst visited the site on a minimum bi-weekly basis during the excavation and remediation of the Zone 1 asbestos void, as well as covering the site wide earthworks and MPP processes. No results for fugitive asbestos fibres over the detection limit of 0.001f/cc air have been encountered.

Copies of all asbestos are quality monitoring results are included in **Appendix 13**.

14.4 Odour and VOC Monitoring

Static mounted Tenex tubes were positioned at 4 locations around the site, focused on the remediation and treatment areas, to record ambient VOC over time. In addition, twice daily perimeter and working area surveys, as well as daily monitoring of the bioremediation treatment and quarantine areas were undertaken using a PID meter to detect for the presence of volatile hydrocarbons and/or solvents.

Monitoring results were assessed on a live basis, with odour suppression being deployed when elevated results were encountered.

Copies of all environmental quality monitoring results are included in **Appendix 13**.

DRAFT

15.0 SUMMARY, FURTHER WORKS AND RECOMMENDATIONS

15.1 Summary

Remediation works have been completed at the former AkzoNobel site, Slough, in accordance with the BGCL Remediation Scheme for Contamination.

Additional ground investigation works undertaken in Summer 2019 and early 2021 better delineated the extent and nature of shallow contamination acting as a source to the associated groundwater plumes. Additional borehole installation and monitoring has established baseline water quality conditions and background data for areas not adequately covered in previous investigations.

A 750m long co-injected ORC and Petrofix Permeable Reactive Barrier (PRB) was installed along the northern-eastern boundary of the site and the proposed spine road separating the northern commercial zone from the southern residential area to protect groundwater quality. The PRB was designed to act as a treatment and attenuation barrier between the groundwater beneath the down gradient residential area and the more contaminated groundwater present in the upgradient northern area of the site. Installation of the PRB commenced in May 2020 and was completed in August 2020.

Floating free phase hydrocarbons present on the top of the groundwater above Plumes 1 and 3 were abstracted using a tractor bowser via a series of dedicated accumulation and skimming wells. In total 43,200l of free phase and contaminated water was recovered from the skimming wells and transferred to an onsite 33,000l green tank bunded tank for subsequent classification testing and offsite disposal. Skimming of free phase continued throughout 2020 until recorded levels were reduced to a non-rebounding sheen for a period of 3 months at all locations, after which all abstraction sumps were decommissioned, and the excavations backfilled with clean site-generated 6F2.

Localised excavation of hydrocarbon and asbestos contaminated soils in the unsaturated zone was undertaken in the Plume1, Plume 2 and Plume 3 areas. Significant deposits of buried waste comprising metal and wooden drums, partially filled with oils and resins, smaller metal drums and paint tins with relic fluids and pigments, oily rags, fabric and wood waste were encountered in both the Plume 1 and Plume 3 areas. These pits were excavated sequentially, with extraneous materials being segregated at excavation prior to transfer to the MPP treatment areas for further sorting, segregation, classification testing and offsite disposal. A total volume of 64m^3 of hydrocarbon contaminated soils, 24 tonnes of mixed paint solids, rags, cans and waste wood and 11 8yard skips of asbestos impacted soils and asbestos waste were disposed of from the site during these remediation works.

Validation samples obtained from the sides and bases of the remediation voids are compliant with the site SSAC, with the single exception of a sample from the westernmost edge of the Plume 1 excavation at 2.6m depth which contains a benzene concentration of 0.180mg/kg compared to the benzene SSAC of 0.033mg/kg. Further excavation in this area was not possible due to groundwater ingress into the deeper sample excavation.

Excavated contaminated soils were transferred to the MPP treatment area and placed in windrows for ex-situ bioremediation prior to reuse as backfill in the excavation voids under the auspices of an approved CL:AIRE Materials Management Plan or offsite disposal. A total of 3,213m^3 of remediated soils were reused in this manner.

Following remediation of the free phase and unsaturated zone contamination sources , groundwater in the cores of Plumes 1 and 3 were treated through direct injection of ORC (Plumes 1 and 3) and RegenOx (BHAN17 area of Plume 3) to enhance aerobic degradation of the residual dissolved phase contamination. Injection was on a nominal 3m x 4m with a treatment depth from the base of the Taplow Gravels at 7m to the top of the water table at 3m. Plume injection works commenced in late July and were completed in October 2020.

Monthly groundwater quality monitoring of the plume specific and site wide boreholes over the remediation period commenced in March 2020, with the first of the post-remediation event being undertaken in September 2020.

Results to date demonstrate overall declining trends in concentrations of the main contaminants of concern, confirming that the remediation earthworks and groundwater treatments have reduced contaminant loading and enhanced aerobic degradation amenable conditions within the saturated zones of the Taplow Gravel aquifer. Results from the downgradient monitoring boreholes are generally compliant with the site Groundwater Guidance Values and confirm that the PRB is providing ongoing protection of down gradient water quality from the northern areas of the site.

A further 4 monthly post remediation site wide monitoring events followed by a further 16 months of quarterly monitoring from the down gradient boreholes are scheduled.

Following completion of the main remediation works a total of 6 ground gas monitoring visits have been undertaken in period of both rising and falling pressure. Elevated methane and PID vapours have been detected at some locations related to the groundwater Plumes 1, 2 and 3. The results of this testing should be used to inform the design of suitable vapour and ground gas protection measures any subsequent development in the Phase 1 and 2 area of the site. .

15.2 Further Works

The following works in the commercial area are outstanding:

- Placement of asbestos soils windrows M7, BTA2 Asbestos 2 and BTA1 Asbestos3 at a suitable location within the Phase 1 and Phase 2 area
- Completion of demolition, lifting of hardstanding and supervised ground proving beneath Building 49, Building 107 in Zone 5, Building 173 in Zone 3, plus the northwest canal side strip of Zone 2
- Completion and reporting of the remaining 4 monthly post remediation groundwater monitoring visits.
- Completion and reporting of the subsequent 6 x quarterly downgradient groundwater monitoring (in the Residential area of the site).

The placement of the remaining windrow materials is anticipated to be completed by April 2021 and will be the subject of an addendum letter report. Groundwater monitoring results will be reported in an addendum letter report following the final May 2021 post remediation monitoring event, with addendum letter reports updating the quarterly monitoring to be produced and issued on a quarterly basis.

Remaining post demolition ground proving works in Zones 2, 3 and 5 will be documented in a separate addendum letter report.

15.3 Recommendations

It is concluded that with the exception of the placement of the remaining site won remediated materials as detailed above, completion of the ground proving works in Zones 2 and 3 and the ongoing groundwater monitoring that the remediation works on the site have been completed in accordance with the agreed Remediation Scheme for Contamination.

Free phase, soil and groundwater remediation works have been completed and validated and dissolved phase contaminant trends in the groundwater demonstrate that groundwater quality is improving. Down gradient site wide monitoring confirms that PRB is providing ongoing protection of down gradient water quality. A volume of 3,213m^3 of contaminated soils have been bio-remediated and reused in backfilling excavations and raising site levels in accordance with the CL:AIRE MMP. soils were reused in this manner.

It is recommended that a brief letter addendum report is produced and submitted to the Local Authority following placement of the remaining MPP windrows in the repository in Zone 3.

It is recommended that a brief letter addendum report is produced and submitted to the Local Authority following completion of the ground proving works in Zones 2, 3 and 5.

It is recommended that the remaining post remediation monthly and quarterly groundwater quality monitoring be undertaken and reported as outlined in **Section 15.2**, and that all relevant monitoring boreholes be retained in order to facilitate this.

It is recommended that this report be submitted to the Local Authority for approval and comment. A copy of this report should also be uploaded into the CL:AIRE portal as evidence that the Code of Practice with regards to the reuse of suitable site won material has been observed.

DRAFT