

**Crest Strategic Projects Limited/
Persimmon Homes (Wessex) Limited
Albright & Wilson Decontamination,
Portishead**

**Final Decontamination Report
Zone 2**

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1.0 INTRODUCTION

1.1 General

This report covers the verification of the decontamination of Zone 2 of the Albright & Wilson (A&W) site at Portishead, as defined by the Schedule of Decontamination Works and shown on Figure 1. The work was carried out between January 1998 and August 1999. Grid-by-grid records of the Zone 2 decontamination can be found in Appendix A.

1.2 Schedule of Decontamination Works

The Schedule of Decontamination Works (SDW) referred to in this document is revision J of the Schedule of Decontamination Works issued by Arup in July 1997. The SDW subsequently formed part of the Section 106 agreement for the Portbury Park development referred to as 'the Albright & Wilson Works', and was agreed to by North Somerset Council, Albright & Wilson (A&W), the developers and Bristol City Council, the landowners.

The standard of decontamination as verified by this report is as set out in the SDW, with agreed variations as detailed in 1.7 below.

Sections 4.0 and 7.0 of the SDW, covering the decontamination of Zone 2, can be found in Appendix B.

1.3 History of Zone 2

Evidence from the history of use of the site shows oil refinery tanks and railway sidings prior to A&W's occupation of the site. A&W built roads and a small area of slab after processing had commenced. A&W also used the zone for stockpiling of materials, slags, phosphate fines and the like, on the surface and disposal of wastes in pits excavated into the underlying alluvium.

1.4 Previous Decontamination Works

Pits 1 and 2, as shown in Figure 1, had been used for depositing phosphorus waste during the life of the works. These pits had been largely excavated prior to the works covered by the Schedule of Decontamination Works. Extracts from A&W's own record of these works can be found in Appendix C.

1.5 End Use

It is intended that the site be developed for residential or commercial use, including buildings, open space, hardstanding and landscaping. There is a no-build zone to the seaward end of the zone dictated by the flood defences. All buildings will be piled, with the exception of small light or insensitive structures.

Method Statements

Arup and North Somerset Council were issued with the Method Statement for this zone (ref PH/JH/010/98) on 10 February 1998. Ove Arup & Partners responded with comments on 19 February, which were resolved at a meeting held on 26 February 1998. No comments were received from NSC and therefore the method statement was deemed approved in accordance with the Section 106 agreement. The method statement and related correspondence can be found in Appendix D and E.

Agreed Amendments to the Schedule of Decontamination Works

1.7.1 Backfill

It was agreed by all parties in the meeting of 3 July 1998 (for minutes see Appendix E) that the clean backfill between 7.5m AOD and 8.05m AOD need not be granular material, and could be clean clay, provided that it conformed to the maximum particle size prescribed by the SDW and was proved by chemical testing or by being natural soil to be free from contamination.

1.7.2 Hydrocarbons

During the course of the excavation work in Zone 2, it became apparent that the volume of oil contaminated material in the ground was significantly greater than was originally anticipated from the early site investigations. In particular, a large brick lined basement structure filled with oil-saturated brick rubble was uncovered to the south of Zone 3 along with numerous pipe runs, sumps and other features. The anticipated cost of off-site disposal, particularly of the more grossly contaminated material, could thus have become excessive and it was also environmentally undesirable.

Ex situ Bioremediation techniques were examined as an alternative. After successful site trials, and extensive discussions with the interested parties, the following criteria for allowing bioremediated material to be encapsulated in cells excavated into the relatively impermeable alluvial clay stratum were agreed as set out in the Method Statements in Appendix F.1.

- (i) Total petroleum hydrocarbons (TPH) shall not exceed 3000mg/kg for 95% of samples and 5000mg/kg for 100% of samples.
- (ii) Polynuclear aromatic hydrocarbons (PAH) shall not exceed 100mg/kg for 95% of samples and 150mg/kg for 100% of samples.
- (iii) The concentration of any one of the 16 US Environment Protection Agency PAH compounds shall not exceed 50mg/kg with the exception of benzo - [a] - pyrene which shall not exceed 10mg/kg.
- (iv) No remediated material to be above 6.5m AOD and to be capped with a minimum of 0.5m of clean alluvial clay.

During the course of the bioremediation works, a large scatter in the end of remediation PAH levels was observed, with the higher results being attributed to discrete tarry lumps. These lumps were considered to be effectively inert in the encapsulation situation and therefore the remediation target criteria were amended as follows, as set out in Arup letter 14 April 1999 (Appendix F.2):

2.1 Meeting the Objectives

Albright and Wilson's method statement PH/JH/010/98 (Appendix D) describes the methods used to decontaminate Zone 2. The individual objectives are addressed below, including the methods of verification and recording, with reference to further details and records within this report.

a) Excavate all existing fills down to natural in situ alluvium

Identification: Alluvium level identified by excavation operative, confirmed by EC.

Recorded: Daily Log sheets, EC diary, lab book..

Reference: 3.2, 4.2, 5.2. Grid Decontamination Sheets (GDS) Appendix A

Verified: Alluvium level sampled, sample numbers included on GDS. No samples showed any visual evidence of hydrocarbon or phosphorus contamination.

Variations: See 6.3

b) Separate out elemental phosphorus, and remove.

Identification & Action: Visually identified by excavation operatives, and other site staff. Removed to skips and disposed of by mudstilling or oxidation

Verified: Interim test results confirmed absence of phosphorus in sampled excavated material. Samples and test results recorded in site lab book.

Reference: 3.2.4, 4.2.4, 5.2.4. Sample numbers recorded on GDS (Appendix A)

c) Complete removal of process wastes and elemental phosphorus from known existing pits.

Identification & Action: Visually identified by excavation operatives, and other site staff. Removed to skips and disposed of by mudstilling or oxidation

Verified: Interim test results confirmed absence of phosphorus in sampled excavated material. Samples and test results recorded in site lab book.

Reference: 4.2.4. Sample numbers recorded on GDS (Appendix A)

d) Remove all calcium silicate slags and phosphate fines.

Identification & Action: Visually identified and removed by excavation operatives. Material not easily separated by excavator mechanically screened to <12mm. Larger material treated as slag, fine material checked with radiation meter to detect slag.

Verification: Top surface of backfilled 'site won fill' see 2.3 subjected to walkover radiation survey.

Reference: 3.2.2, 4.2.2, 5.2.2. Radiation survey Appendix K.

e) Remove all obstructions to piling.

Identification & Action: Obstructions, visually identified by excavation operatives, broken out and removed. Oversize material in 'site won fill' identified and removed by excavation/backfill operatives.

Recorded: Piles left in place as per 5.0ii) of the SDW surveyed for position as aid to future construction.

Reference: 3.2.6, 4.2.9, 5.2.5

f) Inspect alluvium base for presence of additional pits.

Identification: A&W and EC inspected exposed alluvium surface.

Verification: Grid sampling of excavated alluvium surface, recorded in Lab Book.

Reference: Excavated surface sample nos. recorded on GDS Appendix A

g) Excavate any additional pits identified by general excavations.

Action: None identified (see f) above)

h) Remove A&W 'domestic waste' from known tip area and anywhere else.

Identification & Action: Material identified by excavation operatives and bulk excavated and stockpiled for removal offsite. 'Site won fill' inspected by pickers during excavation and backfill operations and 'domestic waste' removed by hand or excavator for disposal offsite.

Recorded: Bulk areas recorded on Daily Log Sheets, EC's diary.

Reference: 4.2.7, 5.2.3. GDS (Appendix A)

i) Identify and remove any other contaminants.

Identification: Known risk areas identified. Visual inspection and vigilance. Inspection by EC.

Verification : See 6.5.1, and Appendix L

Reference: 4.1.4, 4.2.6, 4.2.8

j) Excavate, treat and replace hydrocarbon contaminated material.

Identification: Visual and olfactory identification. Suspect areas sampled for 'bucket' test as per SDW 7.4.

Reference: 3.2.5, 3.3. Appendices F, G & O.

k) Refill with residual screened fills free of phosphorus up to a level of 7.5m AOD

Verification: Sampled for phosphorus as per SDW 4.0. Backfill levels set out by Fowlers and PPM.

Recorded: Daily site log sheets, EC's Diary, Lab Book.

Reference: 4.3.1, 5.3.1. GDS (Appendix A)

Variation: Encapsulation of Bioremediated material - see 3.3.4.

l) Reduce all radiological readings to a consistent background level.

Verification: Radiation Survey

Reference: 6.4, Appendix K

m) Cap with clean demolition hardcore/imported granular fill* (minimum 550mm thick) to a level not less than 8.05m AOD.

Recorded: Daily Site Logs, EC's diary

Verification : Site Won crushed Concrete tested for phosphorus. Sample nos. recorded on GDS

Reference: 3.3.5, 4.3.2, GDS (Appendix A)

Variation: * Relaxed to 'clean imported fill', see para 1.7.

n) Top-off Zone 2 with minimum 150mm of Class 6F2 generally to a level not less than 8.2m AOD

Action: To be completed.

2.2 Identification of Major Contaminants

Material	Identification	Verification
Calcium Silicate Slag	<i>Visual:</i> Bluish-grey angular gravel, sometimes cemented, mainly encountered in distinct strata and pockets.	>10cps on hand held rate meter.
Phosphate Rock Fines	<i>Visual:</i> Off-white/pale brown sub- rounded sandy gravel, mainly encountered in distinct strata and pockets.	>10cps on hand held rate meter.
Yellow Phosphorus	<i>Visual:</i> Ignites and/or fumes on exposure to air.	On-site lab testing as per standing instructions (Appendix J)
Red Phosphorus	<i>Visual:</i> Distinctive red colouring <i>Mechanical:</i> Ignites and fumes when agitated, particularly on mechanical screening.	Sampling as per standing instructions (Appendix J).
Hydrocarbons	<i>Visual and Olfactory:</i> Black viscous appearance, 'rainbow sheen' to standing water, 'oily smell'.	Sampling as per standing instructions (Appendix J). Offsite testing to establish TPH and PAH content.

2.3 Definition of 'Site Won Fill'

The general term 'Site Won Fill' is used to describe material excavated from the site which has been screened to remove elemental phosphorus, calcium silicate slag, phosphate rock fines and oversize material (ie larger than 400mm in any dimension). The use of site won fill as a backfill material is restricted to below 7.5m AOD, as specified in the SDW. The term 'Site Won Fill' is used to distinguish the material from imported fill or crushed site won demolition hardcore which is permitted above the 7.5m AOD level.

Site won fill typically comprises one or more of the following materials, excavated from the Albright & Wilson site during the SDW works:

- Ashy fill (historically imported ash and clinker)
- Limestone and Sandstone Gravel, variously referred to as 'stone', 'ballast' or 'quarry waste' (historically imported from the power station site)
- brick and/or concrete rubble
- clay previously used as backfill within the site

2.4 Residual Contaminants

One of the samples of the site won fill taken by NSC was found to contain a small fragment of asbestos (Appendix L.3) and others to have elevated levels of lead. Despite A&W's reasonable endeavours to decontaminate the site of process related waste and 'other contaminants', it is considered that small amounts of such material will remain within the site won fill. By confining the site won fill to below 7.5m AOD, under 1m of clean cover and restrictions on the development and construction methods on the site it is considered that there is no risk to future users. Correspondence on this issue can be found in Appendix F and chemical analyses in Appendix L.2 and L.3.

The results of the post remediation investigation trial pits, see Appendix M, confirmed that with one exception TP19, all site won fill was below 7.5m AOD. The area around TP19 was subsequently re-excavated to satisfactory levels and backfilled.

3.0 DECONTAMINATION - ZONE 2A

3.1 General Stratigraphy

Zone 2A had an average starting level of 8.3m AOD. A thin layer of overburden overlaid distinct layers of Phosphate Rock Fines (PRF) and Calcium Silicate Slag (CSS). Where railway lines had run in the site, crushed stone probably imported from the power station site which was being built concurrently on the other side of the dock, had been used as sub-base. Below the materials placed by A&W was the surface left after the demolition of the previous structures occupying the site. This included paved areas, floor slabs and basements backfilled with demolition rubble and it was this layer which contained the majority of the hydrocarbon contamination. In places, the hydrocarbon contamination had been covered over with a thin layer of clay backfill. Historically, levels had been made up using ash and clinker imported from the adjacent power station, which was contaminated in places with hydrocarbons. Below this ashy fill was the in situ alluvium, at varying depths.

▼ Ground Level 8.3m AOD approx.

Thickness varies	'Overburden' - Ash/Brick/Clay/Gravel, Calcium Silicate Slag/Phosphate Rock Fines	Albright & Wilson Era Made Ground
Thickness varies 1.0-1.8m bgl ▼ 150-400mm thick	Sandstone and Limestone gravel (where present)	
Thickness varies 2.1-2.5m bgl ▼	Brick and concrete sub-structures (where present) or brown silty clay	Pre-A&W Made Ground
	Hydrocarbon contaminated Ash and clinker/brick and concrete rubble ('ashy fill').	
0.5m + thick	Fissured Silty Clay, sometimes contaminated with hydrocarbons	Alluvium
To depth	Brown to grey Silty Clay	

3.2 Excavation

3.2.1 Overburden

Overburden was visually inspected for phosphorus and excavated to Stockpile A. The locations of the various stockpiles are shown on Figure 3 and the stockpiles are summarised in Table 1.

3.2.2 Calcium Silicate Slag and Phosphate Rock Fines

CSS and PRF were visually identified and excavated to Stockpile B.

3.2.3 General Fill

Clean stone (railway ballast) was excavated, visually inspected and backfilled in Zone 2B and the flood defence roadway in Zone 1. Clean (ie non-hydrocarbon contaminated) ashy fill was generally screened to remove oversize material, slag and to identify red phosphorus. The screened material used as site won fill in Zone 2B.