

Samples of the generally ashy 'site-won fill' up to 2m or so thick from Zone 4 and elsewhere were tested and some were found to contain elevated total heavy metal contents. However, subsequent leaching tests demonstrated that the metal compounds were relatively insoluble and so not available to the environment.

Verification pit TP213 revealed some greenish, grey and orange coloured silty material. This pit was dug near the old boiler house and the silty material appeared to be ashy residues. The pit was enlarged and the material appeared to be only limited in extent. As a check four additional pits (TP214A-D) were dug at a radius of 5m from the original and no such material was found.

On analysis, elevated total metals were found but, again, these proved to be 'non-leachable', see Section 8 and Appendix I.

Zone 4C includes the former transformer installations and there was concern that the concrete slabs in this area may be contaminated with PCBs. Eight samples of surface soils from around the transformer house bund were taken and analysed by Chemex. All contained minute traces of PCBs in the range of 2 to 8 parts per billion. The results are included in Appendix G.

A further nine samples were subsequently taken from the surface concrete and at depths of 300mm and 600mm within the structure. Two samples were also recovered from an area remote from the transformers in order to provide a 'background' comparison.

The maximum level recorded was 39 parts per billion under the transformers but the rest were below 2.5 ppb. The 'background' samples gave results of 1.6 and 9.5 ppb.

These were considered to be negligible and no further action was deemed to be necessary.

## **5.3 Backfill**

### **5.3.1 Site-Won Fill**

As no significant amounts of process feedstocks, residues or phosphorus were anticipated, or found, in this sub-zone, locally dug materials were generally visually screened and used as backfill in adjacent areas. The material was laid in approximately 300mm thick layers and compacted using the D6 bulldozer pulling a 5 tonne vibrating roller.

### **5.3.2 Cover and Capping**

The completed fill was covered by up to 0.7m of crushed concrete to bring finished site levels back up to 8.3 to 8.4m AOD. Only limited amounts of imported clay were used in this sub-zone in the capping layers.

## 6.0 DECONTAMINATION - ZONE 4D

### 6.1 General

The Process House or Mudstills were the last areas to be treated on the site. Work initially proceeded on a piecemeal basis. The boiler, at the southern end of the Process House had to be maintained to supply steam to the mudstill and ancillary operations at the other end.

Underneath substantial concrete floor slabs, there was a variable thickness of mainly ashy fill. This, in turn, overlay an undulating clay surface, partly comprising reworked alluvium, probably from the original dock excavation in 1870, and natural materials. To the west and towards the dock, the original shoreline was re-vetted by coarse limestone rubble and the alluvium level fell away to the dock beneath later ash fill.

The original floor level in the Process House was at about 8.6m AOD and the clay was found at 2m to 5m depth.

#### ▼ Slab Level approx 8.4 - 8.6m AOD

Thickness varies	A&W floor slabs and substructures
2.0 - 5.0m bgl ▼	Crushed stone over ashy clinker
To depth	silty clay Alluvium

## 6.2 Excavation and Demolition - First Pass

### 6.2.1 Demolition

As mentioned above, demolition was done on a piecemeal basis as sections of the Process House became free. The asbestos cement roof sheeting was removed at an early stage by specialist contractors and side infill panels to the steel frame removed to improve access where possible. When the mudstill was shut down towards the end of 1999, the remaining structures including the boiler house and still house were demolished. Clean concrete and brick were stockpiled pending crushing and reuse as cover.

### 6.2.2 Overburden

The concrete floor slabs to the structures, including sumps, culverts and drain surrounds were removed, steamed clear of phosphorus where necessary and stockpiled for crushing. The underlying ashy fill was initially excavated to at least 7.5m AOD, visually screened for phosphorus and stockpiled locally. This work was done during wet weather.

### 6.2.3 Obstructions

Foundation piles were identified and broken down to about 7.5m AOD and surveyed for position.

#### 6.2.4 Other Contaminants, Including Hydrocarbons

The boilers were oil fired and leaks and spills over the years had resulted in some contamination of slabs and fill in the immediate vicinity of the storage tanks and filler points with black, viscous heavy fuel oil. This was visually identified and removed.

#### 6.2.5 Calcium Silicate Slags and Phosphorus Fines

Slag rubble was found to have been used to fill redundant channels and conduits in the Process House floors and this material was separated and disposed of off-site. No phosphate fines were found.

#### 6.2.6 Phosphorus

As expected, yellow phosphorus was found in most of the drain runs, service trenches and sumps in the Process House. This material was removed and placed in skips prior to processing through the mudstill. Lightly contaminated material was spread out to allow the more disseminated phosphorus to oxidise naturally.

### 6.3 Backfill - First Pass

#### 6.3.1 Site-Won Fill

Material originally dug from the footprint of the buildings and neighbouring road was, after visual screening, used to backfill the excavations to about 7.5m AOD.

#### 6.3.2 Cover and Capping

Crushed concrete and brick was used to raise levels to about 8.2m AOD.

### 6.4 Second Pass

#### 6.4.1 General

A 'phosphorus odour' was noted in TP216 dug as part of the verification procedure, see Figure 5, Section 8 and Appendix H just south of the Process House. A trace of visible oil was also noted in TP215. This pit was enlarged to remove the oil and when further check excavations were made around it fuming material was found. Subsequent works in this area revealed 'nuggets' in the 'site-won fill' as well as more dispersed phosphorus that had been placed when this area was treated in late 1999/early 2000. Phosphorus, and oil, was also found in the mainly ashy fill below the original dig depth, particularly around some piles and around other buried structures in a series of excavations and trenches dug at the southern end of the Process House area.

The original works were carried out in accordance with a Method Statement prepared to comply with the requirements of the SDW. Whilst this did not require the area to be dug to 'clean clay', phosphorus, process wastes and obstructions were to be removed as they were found. The daily record sheets, proof testing and site visit notes appear to confirm that this work was carried out.

However, work had been done on a piecemeal basis within the building, as areas became available. The southern end, containing the boilers and the main structure supporting the steam pipes and other plant had to be left until the mudstill was shut down. Thus, material tended to be excavated from one end of the Process House area, stockpiled and replaced in another part. The material was only 'visual screened' as it was dug, moved and placed to check for fumes etc. However, the work was largely done during wet, cold weather between November 1999 and February 2000, which would have tended to inhibit 'smoking' of low level contamination. Also, due to the piecemeal nature of the work, groundwater control was done by local pumping.

As a result of the significant amounts of phosphorus being found in this area Albright & Wilson's successor, Rhodia, then opted to re-excavate the whole Process House area, working to a revised Method Statement, see Appendix D, down to clean clay.

#### 6.4.2 Excavation

The footprint of the former Process House and adjoining boiler house, roadway to the east and an approximately 5m wide strip all around including part of Zone 5 was re-excavated between 8 May and 5 July 2000, see Figure 5.

The clean crushed concrete capping was stockpiled in Grid H8. The underlying mainly ashly fill was then stripped off in thin layers and passed through a Trommel screen. This separated the material into three streams; fine (50mm down), medium (300mm down) and oversize (>400mm).

Excavation continued until clean alluvial clay was found. Any phosphorus contaminated material was separated for treatment and, ultimately, removal from site. In all, some 3,320m<sup>3</sup> of material was taken off site.

Towards the dockside, the excavation extended to levels of 3.6m AOD.

#### 6.4.3 Obstructions

Besides the A&W concrete piles, 12-inch square timber piles were also identified and cut down to alluvium level. Substantial pile off-cuts were also found within the fill at depth along with roughly 2m cubes of concrete. The latter originally supported mooring bollards for the timber wharves. These, as well as a short residual length of A&W retaining wall were removed.

All oversized (>400mm) material was removed from site.

#### 6.4.4 Phosphorus

During the course of the excavations, besides scattered fragments of fiery material and 'fume', significant amounts of phosphorus have been found in two areas. In the centre west side and the north-east corner.

The former appears to be related to a junction in the original drainage trench network and phosphorus collected in the stone rubble underneath. This is the remains of the 'rip rap', which was placed against the clay bank to the dock, probably around 1902 when the timber yard was laid out.



## 7.0 ZONE 4E

This comprises the original A&W office building and the concrete hardstanding and roadways to the south, west and north.

Whilst this area has been continuously sealed by the roads and building, prior to production of phosphorus, there is a slight risk of there being residues from the areas from use in the ground beneath. It was part of the original timber yard. As elsewhere, it is also possible, though not probable, that oil contaminated material was used as fill.

Following demolition and clearance of this part of the site, a site investigation will need to be carried out to check, amongst other things, the general ground conditions, drains and buried structures.

## 8.0 VERIFICATION

### 8.1 General

The decontamination objectives in Zone 4 were met, as recorded in A&W's records, laboratory books, the verification pits and associated remedial works for phosphorus and hydrocarbon decontamination, example extracts are included in Appendix G.

The various records have been collated to give a history of excavation, backfilling and sampling activities for each grid in a Grid Decontamination Sheet. These can be found in Appendix A. The records of the verification pits, tests and associated remedial works can be found in Appendix J.

### 8.2 Routine Sampling

Samples were taken from all material excavated and used as backfill at an approximate rate of 1 per 200m<sup>3</sup> for the main bulk of the works. Following the second pass remediation of the Process House the backfill was sampled at a rate of 1 per 100m<sup>3</sup>. Samples were taken in accordance with A&W Standing Instructions (SI) Nos 1-5 and tested in accordance with SI Nos 7 and 8 (see Appendix F). None of the samples failed the test for phosphorus.

### 8.3 Proving

The excavated surface was sampled on a 10 x 10m grid as prescribed by the SDW. In the furnace and slag bay areas (Zone 4A) this was the alluvium, as it was under the old drum store to the east (part of Zone 4B). Elsewhere it was at 7.5m or below and included old made ground. All samples were tested for phosphorus and all proving samples passed the test.

When the Process House area was re-excavated the exposed alluvium was tested on a 5 x 5m grid. All except one sample passed the test for phosphorus. The failed area was subsequently excavated to remove all traces of phosphorus, re-sampled and proved to be free of residual phosphorus.

### 8.4 Sampling at Final Decontamination Level

Samples were recovered from the top of the site-won fill prior to capping and also tested for phosphorus, all passed.

The SDW also required the filled surface to be monitored for radiation before capping was placed to verify the removal of bulk calcium silicate slag. The radiation survey can be found in Appendix K. None of the readings reached the intervention level of 10 cps.

### 8.5 Off-Site Testing

Ten percent of samples of backfill material were sent off-site to A&W's laboratories at Oldbury for quantitative analysis. All samples tested were found to be below the detection level for phosphorus. The results are included in Appendix G. Samples were tested in accordance with A&W's SI No 10.



## 8.6 Additional Testing

Samples of the site-won fill were recovered by the EC and sent to the laboratories of TES Bretby for metals analysis. The results can be found in Appendix G.

Elevated levels of some metals were found but leachate tests confirmed that the metals were in relatively insoluble compounds and so were not considered to be a significant risk.

North Somerset Council also had samples independently tested and the results of these are also included in Appendix G.

## 8.7 Verification Tests

In order to confirm that the decontamination works had been done satisfactorily, a number of trial pits were dug around the site. These were done in several phases. Their locations are shown on Figure 5 and detailed records of the pits are included in Appendix H.

Soil samples from a number of pits were recovered for analysis at TES Bretby and the results are included in Appendix I.

## 8.8 Remedial Works

As a result of the findings of the pits, local remedial works were undertaken to deal with suspect or contaminated materials. Mention of some of these works have been made earlier in this report and outlines of each are included in Appendix J.

In summary, traces of phosphorus was found in TP304 and TP216. The former was demonstrated to be a localised residue whereas, ultimately, further excavations around, amongst the others, TP216 led to the re-excavation of the Process House and adjoining areas.

Visible and odorous evidence of hydrocarbons was noted in TP27C, TP215, TP216, TP303, TP402 and TP501A.

Elevated chemical analysis results for hydrocarbons and PAH led to further work around TP25-27, TP301, TP503 and TP509.

The areas around TP27C, TP303 and TP402 were excavated until no more evidence of hydrocarbon could be seen. The areas around TP25, TP26 and TP301 were excavated and re-sampled to ensure that the hydrocarbon or PAH contamination had been removed. Records of this work and test results are included in Appendix J.

As a result of the findings of excavations around TP501A and in neighbouring pits, an area measuring approximately 75m north-south and 50m wide was excavated to about 1.5m depth, generally to the top of the clay to check the distribution of the apparently isolated pockets of oily material that had been found previously. A few old water pipelines, pockets of oily stone and traces of phosphorus were found and removed. Representative samples were removed from the sides and base of the area and tested to confirm that no significant hydrocarbon contamination remained.

Some suspect silty material was found in TP213, further pits TP213A-D showed it to be of limited extent. Chemical analysis showed some elevated total metals which were demonstrated to be of low leachability.