Aga Rayburn

Coalbrookdale

Draft Phase 1a Site Condition Report and Phase 2 Site Investigation (PPC)

28 August 2003

Entec UK Limited

Report for

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Certificate No. FS 13881

Executive Summary

To be completed after client approval.

In accordance with the Pollution Prevention Control (PPC) Regulations the Coalbrookdale Foundry site, (the site), owned and operated by Aga Rayburn is obliged to apply for a permit to operate a Part A1 installation for the smelting of iron. The permit application requires the provision of a Phase 1a site condition report describing the condition of the site. This is to enable an initial condition of the site to be assessed and to create a baseline reference against which later determinations can be made as to whether or not deterioration of the site has taken place through the operations covered by the IPPC permit.

The Phase 1a non-intrusive investigation incorporates the gathering of all available information from public domain sources, data searches, and a site reconnaissance. The site is located approximately 4 km southwest of Telford Town Centre, near Ironbridge, Shropshire. It is bounded to the north and south by Ironbridge Industrial Museums; to the west by a railway embankment, to the east by the Wellington Road.

Historical information shows that various industrial works have been present on the site since the 1500s. A foundry works has been present on the site since at least 1709 when the site was taken over by the Coalbrookdale Company. Various activities associated with the casting of ferrous metals have been carried out across the site. A landfill for foundry sand, slag and ferrous scrap metal was present in the south of the site during the late 80s.

The installation area is underlain by Made Ground comprising mainly foundry sand. The thickness is likely to be greatest in the south of the site.

Lyde Brook, a tributary of the River Severn, is present on the western side of the site and is culverted for most of the length of the site. The installation area is serviced by an effluent and surface water drainage system. The surface water drainage system discharges to the Lyde Brook while the effluent from site amenities is discharged to mains sewer.

At depth the site is underlain by a non aquifer (Wenlock Shales). Perched groundwater is likely to be present within foundry sand or underlying natural alluvial deposits beneath the site.

The main process areas within the installation boundary are located on hardstanding. These impermeable surfaces reduce shallow groundwater movement by limiting rainfall infiltration.

Oil and diesel is stored within a bunded area in the south of the site. There is visual evidence that containment measures have been breached (hydrocarbon ponding and staining).

In general the condition of the installation is considered to be reasonable although general housekeeping could be improved, particularly in external areas. Improved pollution prevention measures are required in the south of the site where there is visual evidence of fuel spillages. The condition of the drainage system is unknown and there is the potential for contaminants to enter the shallow ground and groundwater through cracks or discontinuities.

Potential contamination resulting from activities within the installation have been identified from anecdotal and visual evidence and may have impacted on shallow soil and groundwater.

Groundwater and soil quality data for the installation area is lacking. Therefore to confirm the site condition, intrusive works in the form of a Phase 2 (in accordance with current PPC guidance) will be necessary.

Contents

1. Introduction

1.1 Terms of Reference

Entec was commissioned by Aga Rayburn to undertake a Phase 1a site condition assessment and Phase 2 intrusive investigation. The Phase 1a and 2 work has been completed in support of the permit application to operate a Part 1A installation at the site in accordance with the Pollution Prevention and Control (PPC) Regulations.

The findings of the Phase 1a site condition assessment were previously published by Entec in April 2003 (ref 10499 rr025i1). This report combines the findings of both the Phase 1a and 2 investigations as a stand-alone report which supersedes the Phase 1a report.

1.2 Background

The PPC Regulations provide that a permit application must include 'a site report'. This must describe the condition of the site of the installation with regard to substances in, on or under the land which may constitute a pollution risk. This site report is intended to set out the 'initial' baseline condition at the site including any contamination present prior to the operation of the installation and to allow a reference point for comparison with the condition of the site at cessation of operations.

1.3 Scope of Work

The objectives of the 'initial' site report are as follows:

- to review and summarise the historic uses of the installation area and surrounding land, together with a list of potential pollutants associated with the historic uses;
- to identify all substances which are currently used at the installation and likely to be used in the future;
- to review the environmental setting of the site in order to aid in understanding the site condition;
- to obtain sufficient information to allow the development of a "conceptual site model" of the site and its environs. This model describes the inter-relationships between all environmental media, receptors, and contamination which may exist.

The objectives of Phase 1a are therefore to provide an "initial" site report if possible from existing data, or if not, to identify the requirement for further works.

On the basis of the initial Phase 1a report, Entec proposed to carry out a Phase 2 site investigation. The objectives of the Phase 2 Ground Investigation are outlined below:

- identify potentially contaminating process areas or 'suspect' land; and

- assess the potential for on-site and off-site migration of contaminants, particularly through the groundwater regime.

The overall aim of the work is to provide a clear Factual Environmental Statement of the site condition within the PPC application area based on the substances used under permit only. This initial baseline investigation has been designed in order to identify all contamination at the site, associated with current and future activities.

1.4 Information Sources

The following sources of information were used for this assessment.

On-site Sources of Information

- Mr Daryl Grainger, Health and Safety Manager, Aga Rayburn, Telford, Shropshire TF1 5AQ;
- Site Personnel, Aga Rayburn, Coalbrookdale, TF8 7DX including Tom Hogen (Technical Manager), Noel Upton (Health and Safety Advisor) and Keith Lewis (Engineering Manager);
- Entec questionnaire completed by Daryl Grainger, presented as Appendix A;
- Borehole logs from previous site investigation, carried out by Geotechnical Developments, supplied by BGS as discussed in Section 2.7.1 (Appendices C and F);
- Coalbrookdale Watercourse Project, Engineering Report contained in Appendix D;
- A list of materials used on site provided in Appendix H.

Public Domain Sources

- Recent Maps: 1:50 000 scale Landranger Series, Sheet 127, Stafford and Telford, Ordnance Survey 2002, 1:25 000 scale Explorer Series, sheet 242, Telford, Ironbridge and the Wrekin;
- Geology maps and memoirs: 1:25 000, British Geological Survey, Sheet SJ60, Telford (Solid and Drift);
- Historical Maps: Ordnance Survey historical maps from 1848 to recent, at various scales from 1:10 000 to 1:2 500. Historical maps used are listed in Section 2.6 (Appendix E);
- Landmark Envirocheck™ Data Search (Appendix G).

1.5 Site Reconnaissance

Entec undertook a site reconnaissance in March 2003, in the company of Mr Daryl Grainger, Mr Tom Hogan and Mr Noel Upton of Aga Rayburn. Photographs of the relevant areas and activities were taken during the site visit and are included in Appendix B.

1.6 Intrusive Investigation

An intrusive ground investigation was undertaken between the 18 and 24 July, supervised by an Environmental Consultant from Entec.

2. Summary of Findings

2.1 Site Description

Figure 2.1 shows the site location at approximately National Grid Reference 366860, 304410 (SJ 66860 04410).

The site is located approximately 4 km southwest of Telford town centre. It is bounded to the north by land forming part of the "Coalbrookdale Museum of Iron" (the museum), to the south by Wellington Road and a wooded area beyond, to the west by a railway embankment and to the east by Wellington Road, with residential properties beyond.

The site is used for the manufacture of cast iron cookers, stoves and accessories. The proposed PPC licensed activity at the site is the "casting of ferrous metal at a foundry with a production capacity of more than 20 tonnes per day". Associated activities on the site include pattern making and the dressing, painting and assembly of the finished product.

2.2 Site Layout

2.2.1 Overall Site

The general site layout is presented in Figure 2.2, with the site boundary and PPC installation areas defined. The whole site is under the ownership of Aga Rayburn.

Primary access is from Wellington Road to the east.

- The eastern boundary is formed by a 1 to 3 m high embankment, topped with cast iron railings, which separate the site from Wellington Road.
- The southern boundary is formed by the former enamelling shop and the carpark. At its southern end the carpark is bounded by a small 0.5 to 1 m high embankment beyond which is a steep densely vegetated slope with a drop of approximately 20 m to the Lyde Brook which is culverted beneath the western side of the site.
- The west boundary comprises a 2 to 3 m high wooded embankment belonging to the railway.
- The northern boundary is formed by palisade fencing and the walls of the museum buildings.

The main process building is situated in the central and northern portion of the site and comprises a single building divided into separate process areas. Cold blast cupola furnaces are located immediately to the west of the main process building, approximately halfway down the western boundary.

Solid raw materials are stored in covered yard immediately to the south of the cupolas and slag from the cupolas is stored to their north. Casting operations take place on three plants within the western portion of the main process building.

Associated activities including paint spraying, dressing, fettling, pattern making and stove assembly take place in a collection of workshops in the eastern side of the main process building. The southern end of the main process building is occupied by offices, stores and a laboratory used for quality control testing of raw materials.

A bunded area for the storage of fuels and raw materials is located in the south of the site and includes two above ground diesel tanks, oil drums, stockpiled scrap metal and limestone. Skips for wood and waste paper are located on open ground adjacent to the car park in the south of the site.

A variety of materials including electrical and mechanical components, pallets, wood, sheet metal and drums are distributed around the site, but are concentrated on the ground in the south of the site and along the western boundary.

Three substation buildings are present on the site located in the far north east corner of the site, to the southeast of the main process building and on the west side of the main process building.

The main office block is located in a separate building to the south east of the main process building.

The majority of the site is covered with hardstanding (inclusive of buildings). Approximately 5% of the site is covered by gravel with scrubby vegetation, located adjacent to the western boundary in both the north and the south of the site, and to the south of the main process building adjacent to the car park. The site itself is level, however ground falls steeply to the south and rises to the north, east and west.

2.2.2 Installation Application Area

The installation area comprises all of the buildings and external areas on site, with the exception of the former enamelling shop which has been recently acquired by the adjoining museum, and the car park. At the time of the site walkover this area was being used for the temporary storage of general maintenance materials including sheet metal, electrical and mechanical components, pallets and drums, however it is understood that these materials will be removed from these areas.

The following key activities and processes take place within the installation area:

- Furnaces (cold blast cupolas);
- Casting and moulding (including knock down and shot blasting);
- Dressing, fettling, painting and assembly;
- Pattern making;
- Waste materials storage (solid and liquid);
- Raw material storage (solid and liquid);
- Administration;

- Engineering, maintenance and quality control (including laboratories).

The installation area can be divided geographically as indicated below. The activities described above may span the geographical zones listed below:

- Zone A - southern portion of installation area (administration, quality control, raw and waste material storage);
- Zone B - far western portion of installation area to west of main process buildings (furnaces, raw and waste material storage);
- Zone C - central portion of installation area on west side of main process buildings (casting and moulding);
- Zone D - eastern portion of installation area (pattern making, dressing painting and assembly, engineering and maintenance);
- Zone E - Southern portion of site (Carpark and former enamelling shop outwith the installation area).

2.3 Building Functions

A list of buildings and their associated usage is summarised within Table 2.1.

Table 2.1 Building Register - Aga Rayburn Coalbrookdale

Building/Process	Existing/Future Function or Process	Historic Usage
Zone A		
Main Office Block	Security/administration	Former railway sidings
Above Ground Diesel Tank	As described	Former railway sidings
Above Ground Liquid Oxygen Tank	As described	Former railway sidings
Stockyard	Storage of raw materials (ferrous alloys, scrap metal and limestone)	Former air raid shelter later used as paint store located immediately to north, now demolished
Sand and Metal Laboratory	Quality control	Former electricians shop/railway sidings
Technical Services Department	Administration	Former store for building materials/railway sidings
Store	Storage of castings	Former maintenance shop/railway sidings
Pallet Shop	Pallet manufacture	Former store for building materials/railway sidings
Zone B		
Coke Bay	Raw material storage	Former railway sidings

Table 2.1 (continued) Building Register - Aga Rayburn Coalbrookdale

Building/Process	Existing/Future Function or Process	Historic Usage
Stockyard	Raw material storage (coal, limestone, scrap metal)	Former railway sidings
Cold Blast Cupolas x 2	Smelting of internally and externally sourced scrap metal	Railway sidings. Former cooling plant including sulphurous cooling water treated with caustic soda immediately to the west, no longer present
Concrete storage bays	Storage of slag from cupolas prior to removal offsite	Former railway sidings
Zone C		
Shot blasting (South)	Removal of sand from castings using air driven shot	Former mechanical moulding plant
Disa plant	Moulding and casting, including knock out and sand reclamation	Former mechanical moulding plant
No 4 plant	Moulding and casting, including knock out and sand reclamation	Former moulding plant
No 3 Plant	Moulding and casting, including knock out and sand reclamation	Former moulding plant and sand recovery.
Floor Moulding	Casting of master patterns in aluminium and manual compaction of sand moulds	Former core shop
Zone D		
Dressing shop	Hand and machine filing	Former castings store and paint spraying (north)
Stove assembly/castings work shops (store track area)	Painting and assembly of finished product	Former grinding and polishing area (north). Dressing and fettling shop (south)
Packing and Storage Areas	Packing and storage of finished product	Former shake out sand and castings storage area
Gas “control” building	As described	As built
Substation x 3	As described	As built
Compressor building	As described	Former cooling water tank above compressor building, now redundant. Allowed to over flow
Outside toilets	As described	Former railway sidings
Pattern shop	Manufacture of master patterns Includes woodshop with storage of resins and wood treatment products	Dressing and fettling shop
Pattern storage	Storage of finished patterns	Former shotblast area
Maintenance and electrical department	General mechanical, electrical and maintenance equipment	Former despatch bay

Table 2.1 (continued) Building Register - Aga Rayburn Coalbrookdale

Building/Process	Existing/Future Function or Process	Historic Usage
Zone E (Outwith Installation Area)		
Car park	As described	Upper forge pool/foundry sand landfill
Museum building	Currently used for storage of old patterns	Former enamelling shop.

The former uses listed are based on a plan of the site supplied by Aga Rayburn dated 1984, and small scale historical maps dating back to the 1800's. The history of the site is such that it would not be possible to accurately list all suspected former uses, although it is understood from discussions with the museum, that processes carried out within the main process building have been fairly continuous since the eighteenth century, even though the exact location within the building and the plant may have changed.

2.4 Adjacent Land Use

The installation and site as a whole is located in a generally rural area:

- To the north are buildings belonging to the Ironbridge Iron Foundry museum (this land is likely to be a former foundry metal works).
- To the east is Wellington Road with residential housing and a church beyond. A railway line, which serves the Ironbridge Power Station, runs along an embankment along the western boundary of the installation. Beyond this is woodland known as Captains Coppice.
- The site car park and a redbrick building which was formerly an enamelling and grinding shop and casting store, but which now forms part of the Ironbridge Museum, are located in the south of the site outwith of the installation boundary. Beyond this are Wellington Road and a wooded incline leading down to Lyde Brook.

2.5 Environmental Setting

2.5.1 Geology

The 1:25 000 scale, British Geological Survey (BGS), Sheet SJ60, Telford (Solid and Drift) indicates the geology beneath the site to be Wenlock Shale which comprises blue grey silty and shaly mudstones with thin bands of bentonitic clay. This formation has an estimated thickness of 200 m.

The Lightmoor Fault is present cutting across the north of the site which brings the Wenlock Shales into contact with the Lower Coal Measures approximately 150 m to the northeast of the site.

Geological mapping does not indicate the presence of any drift deposits. However, there may be some alluvial deposits associated with the Lyde Brook and the former Upper Forge Pool. The history of the site is such that the entire installation area is believed to be underlain by foundry sand to depths as great as 20 m.

Records held by the BGS include borehole and trial pit logs from a Geotechnical Investigation undertaken at the site in 1995 (refer to Section 2.7.1). These indicate the ground conditions to comprise a varying thickness of foundry sand underlain by Wenlock shales. Two of the boreholes encountered possible drift deposits comprising alluvium, glacial till and glacial sands and gravels at approximately 11 m below ground level. The exact location of the boreholes within the site is unknown but it is assumed that these deposits are associated with the Lyde Brook. The borehole logs are presented in Appendix C.

2.5.2 Hydrogeology

The Environment Agency Groundwater Vulnerability Map 22 (South Staffordshire and East Shropshire) indicates that the Wenlock Shales beneath the site are classified as a non aquifer which means that they have negligible permeability. The Lower coal Measures to the north and east of the site are classified as a minor aquifer which means that they are unlikely to yield large volumes of water but may be important for local supplies. Shallow drift deposits including alluvial silts and glacial sands and gravels maybe present on the west side of the site and, if so, are likely to be in hydraulic continuity with Lyde Brook.

Perched groundwater is likely to be present within the Made Ground and natural drift deposits.

2.5.3 Hydrology and Drainage

Hydrology

The nearest surface water feature is the Lyde Brook (labelled Loamhole Brook on OS map) which is a tributary of the River Severn and flows from north to south along the western boundary of the site. The Brook is culverted beneath the west side of the site for almost the entire length of the site and forms part of the "Coalbrokdale Watercourse", which has been subject to a study sponsored by Telford and Wrekin Borough Council. The Lyde Brook is regularly monitored by the Environment Agency and has a General Quality Assessment (GQA) chemistry grade of B (Good) and a GQA biology grade of D (fair).

A study of Lyde Brook was carried out in 1998 as part of the Coalbrokdale Watercourse Project (CWP) commissioned by Telford and Wrekin Borough Council. The study reports the presence of faecal contamination within the Brook originating from the discharge of raw sewage, upstream of the site. The has been supported by anecdotal evidence from site workers. The study also included a survey of the culvert beneath the site which reported some evidence of blockage and collapse in the upstream section. A plan of the culvert is presented in Appendix D along with extracts from the CWP.

Drainage

There are no formal drainage layout plans available for the site. The location of site drain and manhole covers are presented in Figure 2.3.

Rainwater is collected via roof and surface drainage and discharged to the Lyde Brook to the west of the site. Drains are located around all the main process areas. Exact drainage routes

and discharge points are not known. Cooling water used in the main process building is discharged into surface water drainage. Effluent streams (from site amenities) are collected by separate foul drainage system which discharges to mains sewerage. Foul drains are concentrated along the northern boundary of the site and in the south of the site immediately to the north of the main office building.

2.5.4 Site Sensitivity

The site is located within a predominantly rural area. Residential properties to the east of the site along Wellington Road are considered to be sensitive receptors due to their close proximity to the site.

There are two Sites of Special Scientific Interest recorded within 1 km of the site. The first is Lincoln Hill located approximately 300 m to the south of the site. The second is Tick Wood and Benthall Edge, located approximately 700 m to the south of the site.

The Lyde Brook is sensitive to potential pollutants entering the culvert beneath the site via surface water runoff from the site.

The site is located on a non aquifer. It is possible that shallow perched groundwater may be present within the foundry sands beneath the site which may impact the Lyde Brook via seepage and overland run off. Previous investigations encountered perched groundwater within the foundry sands at a depth of 9.8 m bgl.

2.6 Site History

Historical information on the general site area is taken from Ordnance Survey historical maps, anecdotal information and local history sources. Historical maps are presented in Appendix E and are summarised below.

Ordnance Survey County Series, 1883, 1:2 500

This is the earliest Ordnance Survey map available and shows the study area to be fully developed. A pond labelled the Upper Forge Pool is present in the south of the site in the area of the current carpark. Railway sidings are present covering the rest of the site together with various buildings, the uses of which are unclear.

Residential housing is present, fronting Wellington Road with the Holy Trinity Church beyond. Captains Coppice is present to the west of the railway.

Ordnance Survey County Series, 1890, 1:10 560

The 1890 map shows the site to be largely unchanged from the previous map.

A boring mill is marked approximately 300 m to the south of the site. A quarry is marked approximately 500 m to the south of the site.

Ordnance Survey County Series, 1902, 1:2 500

The site appears to be largely unchanged.

An additional building is present in the south of the site and the Upper Forge Pool has reduced in size.

Ordnance Survey County Series, 1903, 1:10 560
The site is unchanged from the previous map.

The Severn foundry and a malthouse are marked approximately 700 m to the south of the site.

Ordnance Survey County Series, 1927, 1:2 500
The 1927 map shows the centre of the site to be occupied entirely by buildings replacing the former railway sidings.

The remainder of the study area is unchanged from the previous map.

Ordnance Survey County Series, 1928, 1:10 560
The study area is unchanged from the previous maps.

Ordnance Survey County Series, 1938, 1:10 560
The only notable change from the previous map is the absence of the boring mill to the south of the site.

Ordnance Survey County Series, 1954, 1:10 560
The study area is unchanged from the previous map.

Ordnance Survey County Series, 1963, 1:10 500
The site building have been expanded so that that they resemble their current layout. The Upper Forge Pool is no longer marked.

Ordnance Survey County Series, 1996, 1:10 000
The site layout appears unchanged from the previous map.

The Severn Foundry, malthouse and quarry are no longer present to the south of the site. Substantial development has taken place to the west of the site, to the north of Ironbridge in the form of a residential housing estate.

Ordnance Survey County Series, 2000, 1:10 000
The site is shown in its current layout, with the last of the railway sidings replaced by buildings.

There has been some development to infrastructure in the surrounding area.

2.6.1 Summary of Site Development

The following summary of site development has been derived from historical OS maps and information provided by site staff and the Coalbrookdale Museum of Iron.

General
There has been activity on the site since the 1500s although this has only been documented since the 1600s. The Upper forge Pool has reportedly been on the site since the early 17th century and was used to power iron furnaces up to 1864 (Coalbrookdale Watercourse Project). The Coalbrookdale Company first occupied the site in 1708 and in 1709 the first successful smelting of iron with coke as a fuel was undertaken on the site and it was this that

eventually led to the industrial revolution of the eighteenth and nineteenth century. Iron and foundry works have been present on the site ever since.

2.6.2 Historical Information

During the late 19th and early 20th centuries the site was occupied predominantly by railway sidings with the main process buildings to the north, in the area now occupied by the museum. The Upper Forge Pool was located in the south of the site.

By 1927 the railway sidings had been almost entirely replaced by buildings, in a similar configuration to the main process building. Since this time the activities within the main process building are broadly similar to those still carried out today, although the plant and location of various individual processes may have changed.

During the Second World War the site was used for the manufacture of munitions, no further information is available.

The Upper Forge Pool was drained at some point prior to 1961 and during the 1980s the resulting void was licensed as a landfill and infilled with foundry sand, ferrous scrap metal and slag. Site staff report that some flytipping may have taken place in this area and that burned material may include asbestos. The waste management license was surrendered in 1989.

It is Entec's experience of similar foundry sites that undeveloped site areas were commonly used in the disposal of redundant foundry sands. The subsequent construction of buildings and site infrastructure over these areas was not uncommon. The landfilling of foundry sands was regulated from the 1980s. However this practice is likely to have taken place throughout the life of the site.

2.7 Previous Site Investigations

There has been one previous site investigation undertaken, as summarised in Section 2.7.1.

2.7.1 Geotechnical Developments, Geotechnical Investigation, November 1995

This report comprises engineering logs and geotechnical test results from samples retrieved from four trial pits and seven boreholes, excavated in the south of the site in November 1995.

Only one trial pit and one borehole log were available from Aga Rayburn the remaining borehole and trial pit logs were obtained from the BGS. The exact positioning of the boreholes is not known.

The excavations encountered 2.5 to 14.15 m thickness of Made Ground material, comprising brown to black, medium dense sands (foundry sand) with brick, ash and slag. Two of the boreholes encountered possible drift deposits comprising silty clays, sands and gravels which are likely to be associated with the Lyde Brook. The solid geology encountered comprised stiff grey clay of the Wenlock Shales.

Groundwater was encountered within two of the Boreholes at 9.8 m and 10.2 m below ground level, perched within the foundry sand.

Geotechnical testing was undertaken on samples retrieved from the excavations and these are presented in Appendix F together with the borehole and trial pit logs available from Aga Rayburn (the remainder are presented in Appendix C).

2.8 Regulatory Authority Records

Information from regulatory bodies has been compiled principally from the Landmark Envirocheck report which is presented in Appendix G and summarised below .

2.8.1 Integrated Pollution Controls

There are no Integrated Pollution Controls (IPC) registered to the site.

There is one IPC recorded within 1 km of the site, registered to Txu Europe Merchant Generation Ltd (Ironbridge Power Station) for combustion processes within the Fuel and Power Industry.

2.8.2 Discharge Consents

There are four groundwater discharge consents recorded within 1 km of the site registered to private properties for the discharge of sewage effluent.

There are four surface water discharge consents within 1 km of the site. Of these, two are held by Severn Trent for the discharge of storm sewage overflow to the Lyde Brook and the River Severn. The remaining two are held by Txu Europe Merchant Generation Ltd, for treated effluent discharges from the Ironbridge Power Station to the River Severn.

All of the discharge consents predate National Rivers Authority Legislation (1989).

2.8.3 Pollution Incidents to Controlled Waters

There have been no reported pollution incidents at the site since records began in 1995.

There have been fifteen minor pollution incidents to local watercourses within 1 km of the site between 1995 and 1998.

2.8.4 Water Abstractions

There are no current water abstraction licences within 1 km of the site.

A number of surface water abstraction licences are held by the Ironbridge Power Station to the south west of the site.

2.8.5 Waste Disposal

The site was licensed to dispose of Ferrous Metal Scrap, Foundry Sand and Slag within a landfill between 1987 and 1990. The Landfill was located within the south of the installation area and beneath the carpark which is outside of the application boundary.

A further two landfill sites, located approximately 800 m to the north of the site, were licensed in 1987 and 1988 to receive construction waste and inert excavation material.

There are no registered waste treatment or waste transfer sites located within 1 km of the site.

2.8.6 Hazardous Substances

There are no Control of Major Accident Hazards (COMAH) site authorisations within 1 km of the site.

2.8.7 Registered Radioactive Substances

There are no sites with registered radioactive substances listed within 1 km of the site.

2.9 Site Visit and Information Collection

General observations made during the site walkover are presented on Figure 2.4.

2.9.1 Installation Zones

This section describes the general activities currently undertaken within the identified zoned areas of the installation.

Zone A

- This zone essentially contains administration buildings and storage.
- Site access including bulk transportation is controlled from a security office located at the side of the main office block.
- The area is divided between hardstanding and open ground. The open ground is concentrated in the south and west. The surface area comprises a gravel cover with scrubby vegetation. The main access road into this area is via a concrete track with potholes and free standing water with oily sheen.
- A bunded area is present adjacent to the east wall of the southern wing of the main process building and is used for the storage of fuel and raw materials.
- Oil is contained within 25 litre capacity drums within the bunded area. Some drums are present outside of the bunds.
- Two above ground diesel tanks with a joint capacity of 1283 gallons are present adjacent to the bunded area. They are contained within a concrete bund, however site staff reported that the bund occasionally overflows. At the time of the walkover the bund was filled with general debris and free product.
- A third above ground tank is present immediately adjacent to the diesel tanks, which was formerly used for the storage of seperoil. This tank is no longer used.
- Plastic industrial bulk container (IBC) units containing waste hydraulic oil and seperoil replacement are stored on platforms adjacent to the diesel tanks.
- An above tank storing liquid oxygen used for oxygen enrichment within the cupolas is located near the bunded area and the diesel tanks.

- General maintenance materials including wood, sheet metal, electrical and mechanical components, drums and pallets are stored on open ground in the south and west of the Zone.
- The southern wing of the main process building is occupied by the pallet shop, offices and a laboratory used for quality control.
- Metal skips for wood and waste paper are stored on the open ground adjacent to the car park.
- An area of scrubby vegetation is present in the far south of the Zone.

Zone B

- Bounded to the west by railway embankment and to the east by the main process.
- Raw materials, limestone, coal, coke, clay stored in a covered yard immediately adjacent to the main process building.
- Cold blast cupolas for smelting of iron.
- Slag is collected from the furnace and stored in the north of the site.
- Red brick underground tanks, thought to be Victorian interceptors, by Aga personnel, are present in the north of the zone close to the culvert inlet.
- A former above ground cooling and setting tank was located opposite the cupolas on the west boundary. The tank contained sulphurous water from the cooling process which was treated with caustic soda. The tank was removed approximately 5 years ago.
- Miscellaneous materials, including electrical and mechanical components, sheet metal, wood etc, are stored on open ground and against buildings throughout the zone.

Zone C

- This zone occupies the west side of the main process building and comprises the main moulding and casting plant (No 3 plant, No 4 plant and Disa plant).
- The entire area has concrete flooring which is cracked and has black stain. Foundry sand is present over most of the floor particularly in the knocking out areas, and the black staining is most probably due to the coal dust content of the sand.
- Molten iron is transported via overhead conveyors to each plant.
- Silica sand is delivered directly into storage hoppers in each of the plants, for immediate use on the moulding plant.
- The sand used at each plant is recycled, via above and below ground conveyor systems.
- Sand is removed from castings through the knock down and shot blast process. Castings are manually beaten or mechanically vibrated to remove the bulk of the

mould (knockdown). The sand is collected via metal grids within the floor and is returned to the hoppers via the conveyor system. The shot blast process uses air driven shot to remove and clean the finer particles of sand. Dust from the shot blast process is collected via the foundry extraction system.

- Cooling water for casting and moulding plant, is directed into the surface water drainage system.
- Lubricant and oil containers, both full and empty, were present across the area, most were placed on benches or pallets but some were stood on the floor.
- Manual compaction and moulding is carried out along the west wall (Floor Moulding area). There is much spillage of foundry sand in this area.
- Casting of master patterns in aluminium is carried out in the west of the zone, adjacent to the floor moulding area.

Zone D

- The eastern section of the main process building comprises workshops and storage areas.
- Dressing, fettling, painting, assembly, packing and storage of stoves takes place in the north of the zone.
- Painting takes place in booths within the Stove Track Area. Fumes are passed through a water curtain and removed via the extraction system.
- Solvent contaminated water, from the paint booths, is stored in IBC units outside of the building.
- The entire area has concrete floors which are cracked and stained in places.
- The majority of chemicals used in this zone, including paints and resins, are stored on pallets, shelves or within cupboards within the area where they are used. Drums and containers, both full and empty, are evident throughout the area, both inside and outside of the building.
- Pattern manufacture including wood shop and general maintenance workshops, are located in the south of the area.
- Miscellaneous materials including electrical and mechanical components, sheet metal, wood etc, are stored outside of the building.

2.10 General Activities

2.10.1 Materials Storage and Movement

Raw Materials

Bulk raw materials including coke, internally and externally sourced scrap metal, limestone, ferrosilica and ferromanganese, are stored within a covered yard, in Zone B to the west of the

main process building. Some scrap metal and limestone is also stored within the bunded area in Zone A adjacent to the access track.

Chemicals used in the various processes, including paint resins, lubricants, fuels and degreasers are generally stored within drums and contained within the areas where they are used. All are contained within hardstanding areas and most are stored on shelves or pallets. Empty drums are stood around the site, particularly within Zone A.

Movement of raw materials from the stockyards in Zone B to various areas within the main process building is facilitated by a combination of conveyor belt systems and forklift trucks.

Underground Tanks (USTs)
No USTs were in use on the site. Two red brick pits thought to be Victorian aged interceptors are present adjacent to the western boundary near the inflow to the culvert in the northwest of the installation area.

2.10.2 Process Areas

Furnaces (Cold Blast Cupolas, Zone B)
Scrap metal is melted within two cold blast cupolas to obtain molten iron. The cupolas are contained on an area of hardstanding. Molten slag is discharged from the bottom of the furnaces and allowed to cool before being moved to a concreted area in the north of the site. Fumes from the cupolas are passed through the foundry extraction system and a dry bag filter is used to collect particulates which are then bagged and removed offsite. The cupolas are fuelled by coke which is stored within the main stock yard in Zone B. Liquid oxygen for use in the cupolas is stored within an above ground tank in Area A.

Casting and Moulding (Zone C)
This uses the greensand moulding process to produce mouldings, used for the casting of molten iron. Operations are carried out at three multipurpose plants (Disa plant, No 3 plant and No 4 Plant). Silica sand is treated with clay water and coal dust and inert binders prior to compaction and moulding. Linseed oil is used as a binder with carbon dioxide as a catalyst. The linseed oil is stored within a 45 gallon drum within the core shop. The carbon dioxide is stored within cryo tanks within the core shop in the west of Zone C. Silica sand is delivered directly to storage hoppers within the process area.

Sand mouldings are broken down via the knock out process and the sand is returned to the hoppers via a conveyor system to be reused. Castings are shotblasted to remove fine sand. The metal shot and sand dust is collected via the foundry extraction system, bagged and removed offsite. Sand from the knock out process is collected through grids in the floor and returned to the hoppers. Foundry sand is widespread across the building floor and is tracked across site by vehicles and site workers.

A small proportion of sand is treated with a phenolic resin to produce shell sand, which is used to produce cores for hollow castings.

Manual compaction of the sand is carried out within the floor moulding area. Much sand spillage is evident in this area.

Dressing and Painting (Zone D)
Grinding and painting of castings takes place in the dressing shop and stove track area respectively, in the north of Zone D. Painting is carried out within booths with a water curtain to extract solvents. The solvent water is stored outside the building in IBC units. Swarf and chippings are evident on the floor, this is collected and removed offsite. Chemicals (paints, lubricants etc) are stored in drums or containers, most are stored on shelving or pallets, some unlabelled drums and containers are evident throughout the process area.

Pattern Making (Zone D)
Patterns for the moulds are initially made in wood, within a separate workshop in the south of Zone D. All resins used on the wood are stored on shelving within the woodshop. The master patterns for the mouldings are cast in aluminium within the floor moulding area in Zone C.

2.10.3 Waste and By- Product Management

Solid Waste
General waste (wood and paper) is stored in two skips, on open ground to the south of the main process building.

A small metal skip is kept within the Stove Track area within Zone D, which is used to collect empty paint and resin tins. When full this is removed to another Aga Rayburn site, where it is collected by a specialist waste contractor. The skip is located on hardstanding, but is not bunded.

Particulates from the cupolas and dust from the shotblast and fettling areas are collected via the extraction system. Swarf and chippings from the dressing area and the wood shop are collected via regular sweeping and placed in bins within the machine shop. These waste streams are bagged and transferred via forklift to a skip and removed off site by a specialist waste contractor.

Liquid Effluent
The only liquid effluent generated is cooling water used on the main casting and moulding plant and water used as a filter in the extraction system within the paint booths. The former does not come into contact with any process materials and is collected by the surface water drainage system and discharged to the Lyde Brook. The latter is collected and stored within plastic IBC units outside the process building in Zone D and removed offsite by a specialist waste contractor.

2.10.4 Ancillary Processes

Fuelling Points
Diesel for use in the plant machinery is stored within two above ground tanks (270 gallons and 513 gallons) within Zone A. Oil is stored in 25 litre capacity drums in the bunded area in the south of the site and distributed around the site in small containers which are kept on benches or next to machines in the process areas. Although the diesel tanks are bunded there is evidence of spillage around the bund. At the time of the walkover the bunded area was filled with general debris and water with free product on the top. Site staff report that the bunding often overflows. Standing water with an oily sheen was apparent in this area.

Transformers

Three substations are present on site, one on the western boundary of Zone C, one in the far north of Zone D adjacent to the outside toilets and one in the south of Zone D adjacent to the electrical and maintenance department. Two of the transformers (Area D South and Area C) were contained within locked units and were not inspected. It is therefore not known whether or not these are of an age likely to contain PCB containing oils. The third substation (Area D North) appeared to be relatively new and is, therefore, unlikely to containing PCB containing oils.

A gas main enters the site from Wellington Road to the east and terminates within the gas control building outside the main process building, within Zone D.

2.10.5 Raw Materials and Site Chemicals

Raw materials and site chemicals are limited to the following main compounds: coal, coke, clay, limestone, silica sand, oils, lubricants, fuel, paints, laquers resins and thinners. A full chemicals list as provided by Aga Rayburn is presented within Appendix H.

2.10.6 Environmental Management

There is currently no accredited environmental system in place at the site. Procedures aimed at minimising environmental impacts are currently being developed as part of the PPC process.

2.10.7 Visual Evidence

In general the site appeared to be in reasonable order although the external areas did show evidence of poor housekeeping with miscellaneous scrap materials including sheet metal, wood and mechanical and electrical components left around the site on open ground.

Waste and raw materials were stockpiled in various areas around the site and although bunds were present in the form of wooden and concrete bays the materials were not always fully contained.

Visual evidence of contamination was noted only around the diesel and oil storage area in the south of the site. With the exception of the foundry sand which is reused. The process itself generates very little waste and although floors within the main process building appeared stained this is generally thought to be due to the coal dust within the foundry sand. The deterioration of the floor is to be expected given the age of the building.

Given the age and history of the site former practices are likely to have resulted in ground contamination in particular poor management of cooling water, fuel and chemical storage and disposal of foundry sand.

2.11 Proposed Operations

No changes to existing site operations are foreseen in the short term. Therefore, the chemicals and materials used on site are unlikely to change, should this scenario change further assessment will be required.

2.12 Assessment of Chemicals of Concern

Based on the information above regarding processes and materials present on the site groups of potential Chemicals of Concern (COCs) associated with past and present activities on the site, have been identified within Tables 2.2 and 2.3. The chemical groups have been assessed on the basis of their potential to cause harm to the environment and the volume used on site. A list of chemical products used on site together with quantities is given in Appendix H.

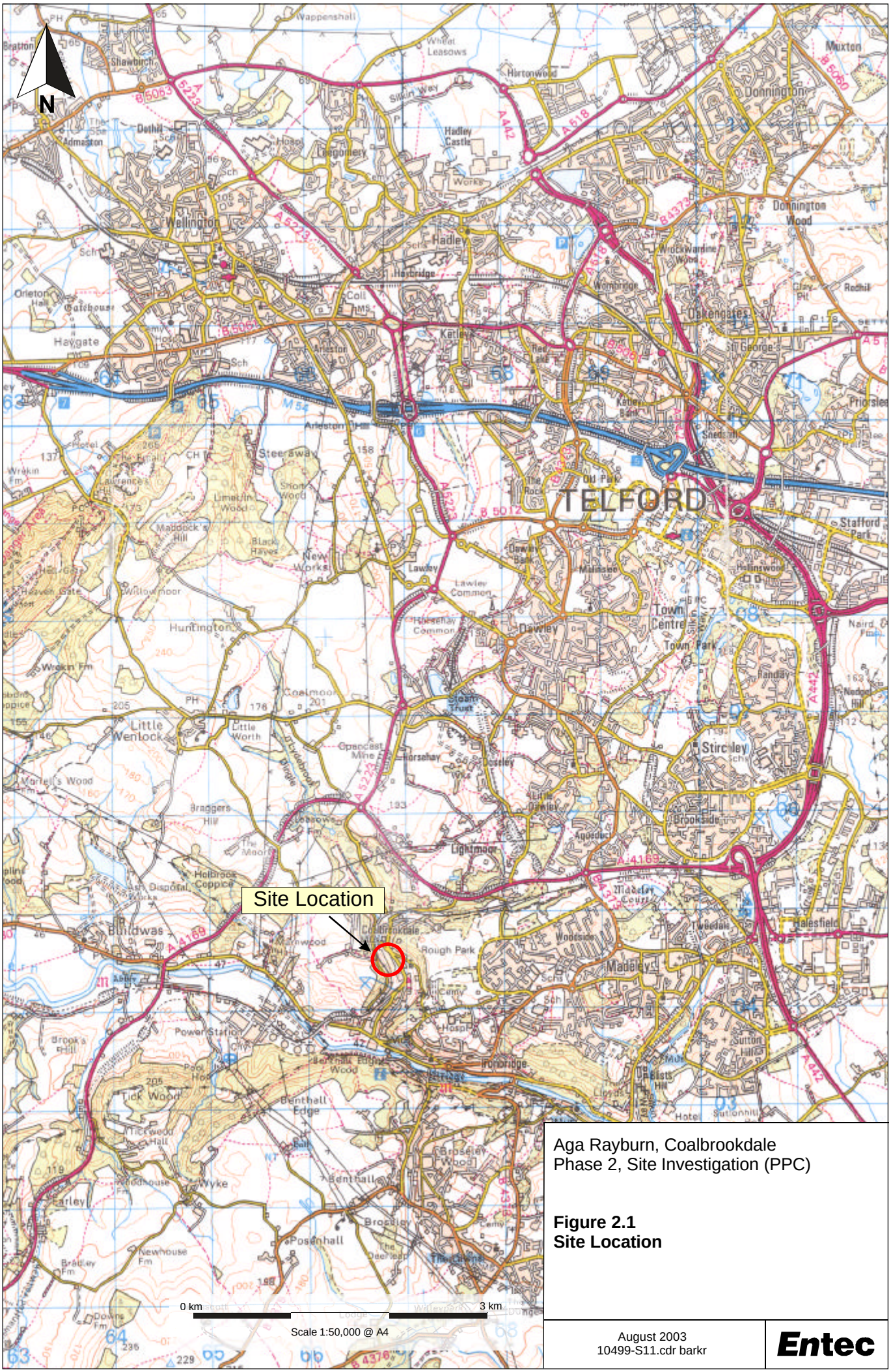
Table 2.2 COCs Associated with Historical Activities

Chemical	Material/Process	Area	COC Under Current PPC
Diesel	Used in plant machinery stored in various areas of the site. Also associated with former railway sidings	Exact location of historical storage unknown	Y
Oil	Used in plant machinery stored in various areas of the site	Exact location of historical storage unknown	Y
Solvents	Contained in paints and resins. Stored in various areas of the site	Exact location of historical storage unknown	Y
Hydrocarbons including BTEX	Contained within lacquers, resins, thinners and lubricants	Exact location of historical storage unknown	Y
Phenols	Used as a binder within shell sands	Landfill for foundry sand located in Zone A	Y
Anti-floculants, biocides and antioxidants	Used within coding water and allowed to drain on to land	Zone D	N
Sulphuric Acid	Cooling water used on cupolas. Treated with caustic soda	Zone B	N
Dioxins	By products from combustion process	Zone B. Historic location of furnaces unknown	Y
Polycyclic Aromatic Hydrocarbons (PAHs)	Former railway sidings	Zones A, B, C and D	N
Heavy Metals	Associated with former railway sidings and raw materials for foundry process	Zones A, B, C and D	Y
Asbestos	Associated with former railway sidings	Zone A, B, C and D	N

BTEZ = Benzene, Toluene, Ethybenzene and Xylene

Table 2.3 COCs Associated with Current Site Activities

Chemical	Area/Material/Process	Comment	COC Under PPC?
Diesel	Used in plant machinery stored in two above ground tanks in Zone A	Signs of spillage around tank, used historically	Y
Oil	Stored in drums in bunded area in Zone A and in small containers within Zones C and D	Signs of spillage, used historically	Y
Solvents	Contained in paints and resins used within Zone D and waste water stored outside main process building	Highly mobile and damaging to the environment	Y
Alcohols	Used within the laboratory as part of quality control (Zone A)	Small volumes only used	N
Hydrocarbons including BTEX	Contained within laquers, resins, thinners, lubricants and fuels (Zones C & D)	Widespread and long term use across site	Y
Acids	Used within the laboratory as part of quality control (Zone A)	Small volumes only used	N
Phenols	Used as binder within shell sands (Zone A, B, C & D)	Large quantities of foundry sand likely to be present beneath site	Y
Dioxins	Contained within gases and particulates from cupolas (Zone B)	Long term production	Y
Metals	Scrap metal used as raw material, maintenance materials around site, old patterns and castings, former railway sidings (All Zones)	Wide spread and long-term use across site	Y
Polychlorinated biphenyls (PCBs)	Transformers (Zones C & D)	Highly toxic. Not known whether transformers are sealed units or of age to contain PCBs	Y
Carbon Dioxide (CO^2)	Gales associated with landfilling of foundry sand (Zone A)	Asphyxiant	Y
Flammables (Methane)	Gales associated with landfilling of foundry sand (Zone A)	Explosive gas	Y

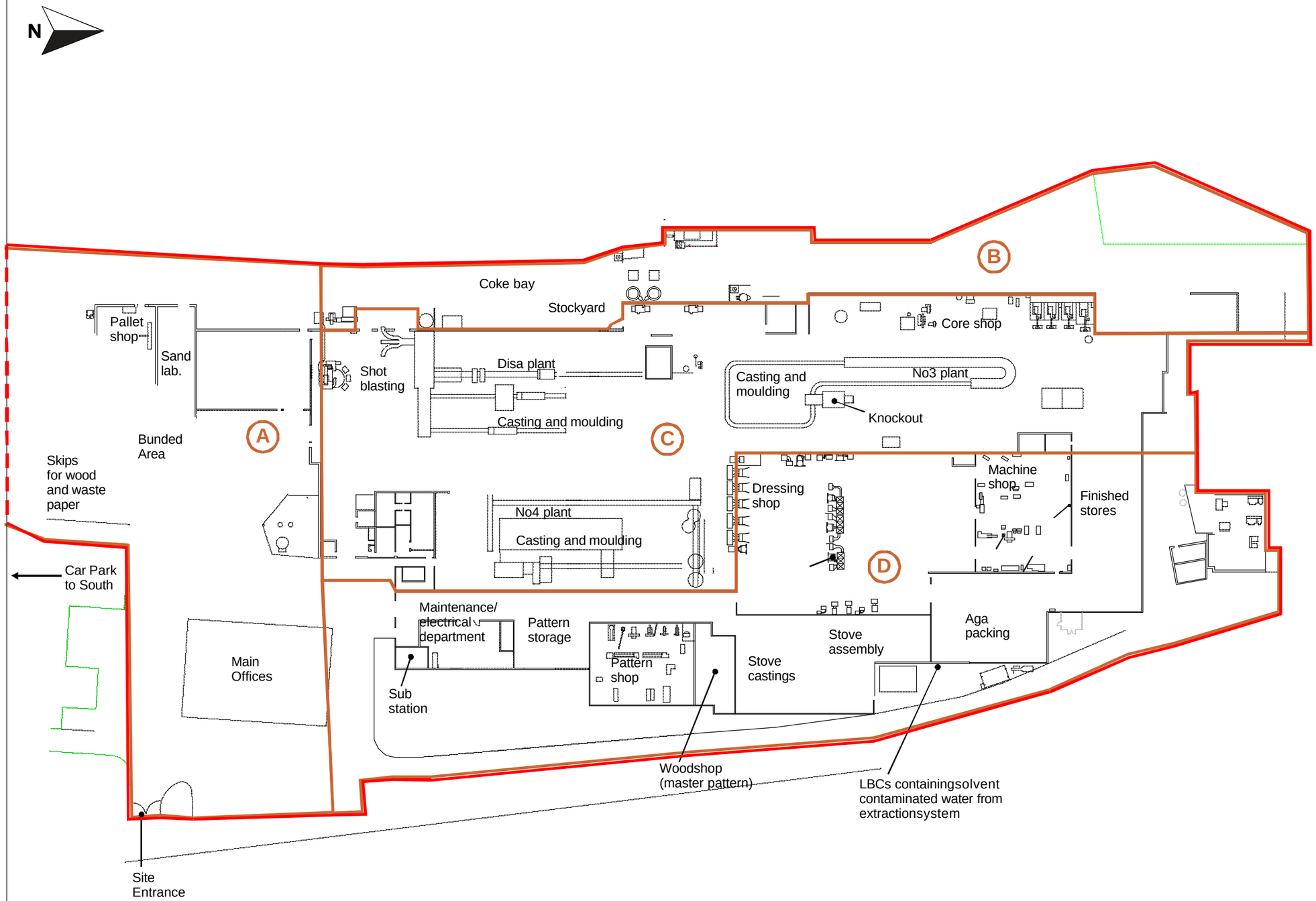


Aga Rayburn, Coalbrookdale
Phase 2, Site Investigation (PPC)

Figure 2.1
Site Location

August 2003
10499-S11.cdr barkr

Entec



Key

Installation Application Boundary

Zones

0 m 50 m

Aga Rayburn, Coalbrookdale
Phase 2, Site Investigation (PPC)

Figure 2.2
Site Plan

August 2003
10499-S12.cdr barkr

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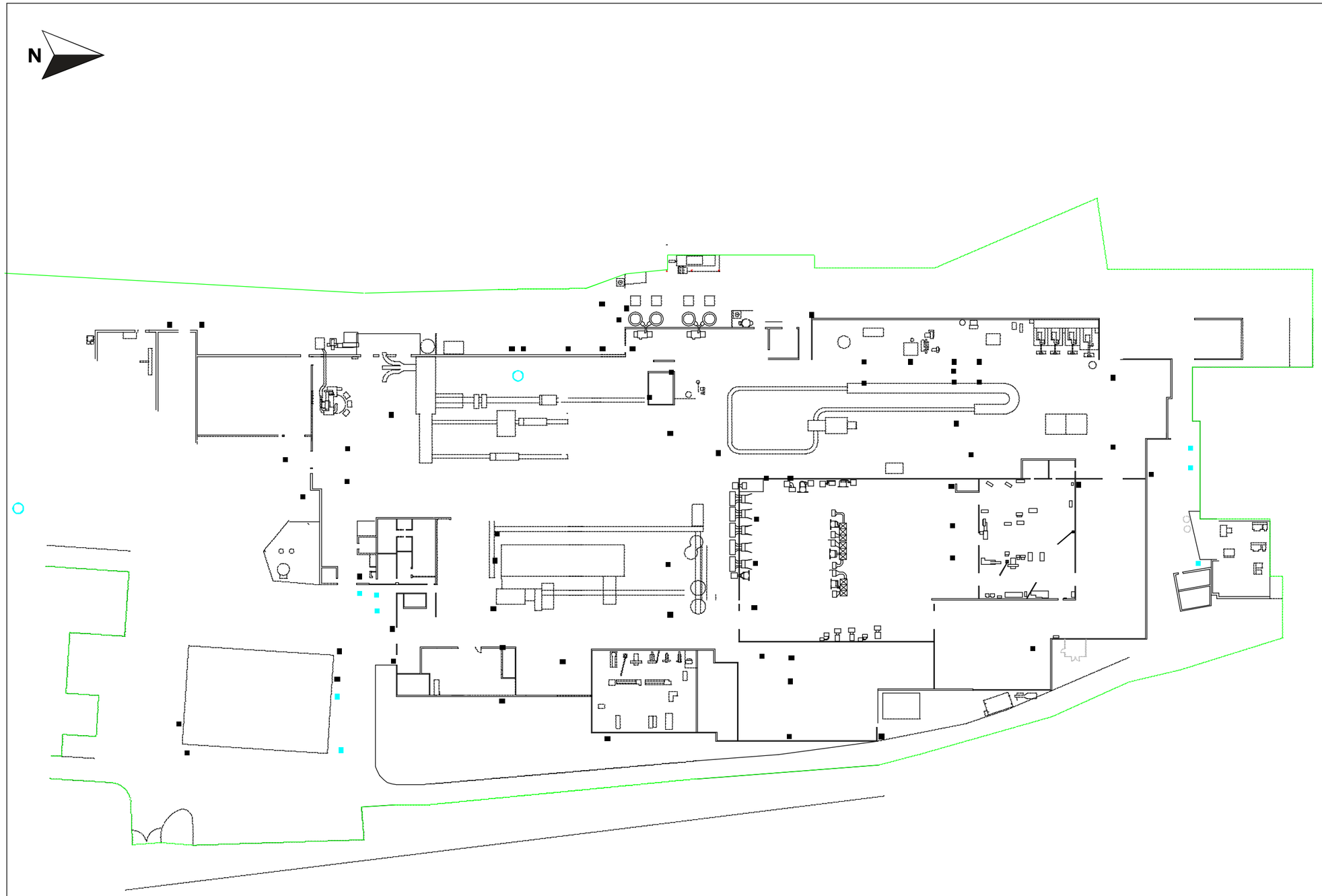

Key

Drain Covers

- Rainwater
- Sewage
- Culvert entry points (manholes)

0 m 50 m

Aga Rayburn, Coalbrookdale
Phase 2, Site Investigation (PPC)

Figure 2.3
Drainage Plan

August 2003
10499-S03.cdr barkr

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N

Drums, pallets etc. Removedoffsite

Open ground. Skips andgeneral waste materials deposited on open land

Extractor collects dust from knockdown and shot blast processes. Bagged andremoved off site.

This areaofbuilding replaced 3 years ago

Covered yard for storage of raw materials. Hard floor covering

Cupolas

Former sulphurous tank from cooling processtreated with caustic soda. Spillage likely. Tank removed 5 years ago.

Floor/manual moulding

Sub station

Concretebay. Storage area for slag Removedoffsite

Red brick underground tanks. Thought to be victorian interceptors. Were cleared of sludgeapproximately 2 years ago.

Open ground with scrubby vegetation

Open land withscrubby vegetation. General maintenance materials and miscellaneous scrap

Coke bay

Stockyard

Overhead pipe,formerlythe overflow for sulphuric acid tank

Pallet shop

Sand lab.

Technical Services department offices

Shot blasting

Disa plant

Casting and moulding

Core shop

Grids present in floor to catch and recyclesand

Casting and moulding

No3 plant

Knockout

Compressor

Oil and dieselstorage. Bunded but evidence of leaks andspills. Diesel tank bund blocked with general debris.

Skips for wood and waste paper

Former air raid shelter and paint store. Now demolished

Hard covered floors throughout main process area

Dressing shop

Spray booths connected to extractor system

Machine shop

Finished stores

Store for civil engineering/ building materials

Waste materials, limestoneetc, stored in concrete bays. Bays in poor state of repair.

No4 plant

Casting and moulding

Fettling

General maintenance materials and miscellaneous scrap

Liquidoxygen tank

Foundry sand present on floor throughout main process area

Sub station

Oily water present in roadway andon open ground

Maintenance/ electrical department

Pattern storage

Pattern shop

Stove assembly

Aga packing

Office block

Stove castings

Sub station

Hardstanding

Gas control building

Aboveground tank formerly used for cooling water. Now used only for rainwater and allowed to overflow

Hardstanding

Woodshop Resins etc stored on shelving

IBCs containingsolvent contaminated water from extractionsystem

Outside toilet

Site boundary: embankment approximately 2m high topped with iron railings

Building now owned by museum. Former enamelling shop. Currently used to store old patterns.

Key

- Installation Application Boundary
- Castingandmoulding (shot blasting, knockout, core making). Current/historical
- Dressing (fettling, spraying, stove assembly). Current/historical
- Pattern making. Current/historical
- Maintenance (includingstores, electrics). Current/historical
- Administration(offices, technical services). Current/historical
- Raw and waste material storage. Current/historical
- Principal activity smelting. In cold blast cupolas
- Red text — Observations Made During Walkover

0 m — 50 m

Aga Rayburn, Coalbrookdale
Phase 2, Site Investigation (PPC)

Figure 2.4
Observations Made During Walkover

August 2003
10499-S14.cdr barkr

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3. Intrusive Investigation

3.1 Introduction

The overall objective of the baseline investigation was to provide a clear factual environmental statement of the site condition within the identified zones within the overall PPC installation area, based on the substances used within prescribed activities detailed within the permit.

The baseline investigation has been designed to enable identification of all contamination associated with current / future activities and be sufficiently thorough to defend against future claims or allegations of contamination arising from the current site activities.

On the basis of the Phase 1a study, an intrusive ground investigation was designed to target previously identified issues, as outlined below in Table 3.1. Aga Rayburn approved the site investigation design prior to commencement of work.

Table 3.1 Exploratory Hole Targets

Exploratory Location	Area/Activity	Analysis Suite
Zone A		
WS1	Infill	TPH, Metals, Phenols
WS2	2 Diesel Tanks adjacent to Bunded Area	TPH, Metals, Asbestos
BH1	Monitoring South West Boundary	Metals, TPH
Zone B		
WS4	Infill, waste from extractor system	Metals, Phenols, Asbestos
WS5	Coke Bay/Stockyard	Metals
WS6, WS7, Surface sample	Cold Blast Cupolas	SVOCs, Dioxin (surface sample)
WS8	Slag Storage	Metals
BH2	Monitoring South West Boundary	Metals, TPH, SVOCs, VOCs
Zone C		
WS9	Disa Plant	VOC (including BTEX), SVOC, Metals, Phenols
WS10	No 4 Plant	VOC (including BTEX), SVOC, Metals, Phenols
WS11	No 3 Plant	VOC (including BTEX), SVOC, Metals, Phenols
WS16	Substation	PCBs

Table 3.1 (continued) Exploratory Hole Targets

Exploratory Location	Area/Activity	Analysis Suite
Zone D		
WS12	Maintenance/electrical department, Substation	VOC, SVOCs, PCBs
WS13	Dressing Shop	VOC(including BTEX), SVOC, Metals, Phenols
WS14	Stove assembly/IBCs containing water from extraction system	VOC(including BTEX), SVOC, Metals, Phenols
BH3	Monitoring Eastern Boundary	VOCs, SVOCs, Phenols

TPH = Petroleum Hydrocarbons, VOCs = Volatile Organic Compounds, SVOC = Semi-volatile Organic Compounds

The investigation was completed between the 18 and 24 July 2003, under the supervision of an Environmental Scientist from Entec.

Prior to any excavations at the site, a works contractor (Subscan) was employed to clear all the services at each exploratory location. Hand dug inspection pits were excavated to a depth of approximately 1.2 m bgl at each location. In areas of concrete hardcover a concrete corer was used to produce a 350 mm diameter hole to provide access for hand digging. Information obtained on services within the site boundary and in the surrounding area is included as Appendix I.

The ground investigation comprised three boreholes (BH1 to 3) excavated to prove natural ground and fourteen window samples (WS1 to 14) excavated to depths of up to 3 m. The boreholes and trial pits were positioned in areas, both inside and surrounding the plant, in order to focus on potentially contaminating process areas and current and former oil, paint and waste storage areas. The exact location of each borehole and window sample were agreed with the Engineering Manager at Coalbrookdale.

During the excavations, the arising soil was logged in accordance with BS 5930 1999, Code of Practice for Site Investigation. Records of the boreholes and window samples are included as Appendix J.

All excavations were reinstated to the original condition following the ground investigation Keith Lewis (Engineering Manager) approved the reinstatement of all exploratory holes.

Figure 3.1 shows the locations of exploratory holes.

3.2 Soil Sampling

3.2.1 Window Samples

Soil was collected as composite samples directly from the window sample drill, ensuring that no strata boundaries were crossed when sampling. The soil samples were of sufficient size for chemical testing using laboratory prepared and approved containers. Typically one or two samples were collected per location.

3.2.2 Chain of Custody

All samples were transported to the laboratories of Alcontrol Geochem at the end of each day of fieldwork, with full Chain of Custody documentation.

3.3 Laboratory Testing

3.3.1 Chemical Testing

A total of twenty four soil samples were analysed for a standard suite of determinands comprising:

- Metals, including arsenic, cadmium, chromium, hexavalent chromium, copper, nickel, zinc, lead, mercury, water soluble boron, selenium;
- Inorganics, including total cyanide, free cyanide, thiocyanate, total sulphate, sulphide, total sulphur and pH;
- Organics, including total phenols and polycyclic aromatic hydrocarbons (PAHs).

Selected samples were also analysed for the following determinands based on current and historical processes;

- Dioxins;
- Organics, including TPHs, PCBs, SVOCs and VOCs;
- Asbestos.

One groundwater sample was collected and analysed for a standard suite of determinands comprising:

- Metals, including arsenic, cadmium, chromium, copper, nickel, zinc, lead, mercury, boron, selenium;
- Inorganics, including total cyanide, soluble sulphate, sulphide, free sulphur and pH;
- Organics, phenols, TPH, SVOCs and VOCs.

Leachate testing was carried out on five soil samples and analysed for the following suite of analysis:

- Metals, including arsenic, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc;
- Inorganics, including total cyanide, sulphate, sulphide and free sulphur;
- Organics, including total phenol.

The results are discussed in Section 5 and the certificates of analysis are presented in Appendix K.

N

WS1
BH1
Pallet shop
Sand lab.
WS2
Bunded Area
Skips for wood and waste paper
Car Park to South
Site Entrance
Main Offices
Toilets
WS4
Shot blasting
Coke bay
WS6
WS7
WS5
Stockyard
Disa plant
Casting and moulding
WS9
A
C
Shower block for emergency use
Tap for water supply
WS10
No4 plant
Casting and moulding
WS12
Maintenance/ electrical department
Pattern storage
Sub station
Pattern shop
BH3
Woodshop (master pattern)
WS8
B
BH2
Core shop
WS16
Casting and moulding
No3 plant
WS11
Knockout
Dressing shop
Machine shop
Finished stores
D
WS13
Stove assembly
Stove castings
Aga packing
WS14
LBCs containingsolvent contaminated water from extractionsystem

Key

- Installation Application Boundary
- Zones
- Cable percussionborehole
- Windowsample probe hole to 3m depth
- Approximate location of culvert

0 m — 50 m

Aga Rayburn, Coalbrookdale
Phase 2, Site Investigation (PPC)

Figure 3.1
Exploratory Locations

August 2003
10499-S09.cdr pattn

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4. Ground Conditions

4.1 Strata Encountered

The ground conditions encountered during the intrusive investigation correspond with the information obtained from BGS Records and British Geological Survey (BGS) solid and drift mapping.

Concrete covers the majority of the site, including inside buildings and areas surrounding the plant. Areas adjacent to the car park in the south of the site and areas in the northwest of the site, comprise open rough ground with scrubby vegetation.

Made Ground was encountered beneath the site at all exploratory locations to depths of between 0.6 m and 3.0 m bgl. Natural ground was encountered at five locations, beneath the Made Ground deposits.

Ground conditions encountered at the site are discussed in detail below.

4.1.1 Made Ground

Foundry sand was encountered beneath the concrete or topsoil in all of the exploratory locations. The foundry sand comprised dark brown slightly silty coarse sand and ash and gravels with many cobbles and boulders of concrete and brick and many fragments of slag.

The depth of the Made Ground was not proven in all exploratory locations. The Made Ground ranged from 0.5 m to 9.0 m in thickness. The foundry sands were thickest in the south of the site, near to the former Upper Forge Pool, which was used as a landfill during the 1980s.

4.1.2 Natural Ground

Natural ground was encountered at five out of seventeen locations at depths ranging from 0.7 m (WS1) to 9.0 m (BH1). The natural ground generally comprised very stiff light brownish yellow laminated clay with few fine subangular gravels, rare cobbles and many rootlets and was possibly weathered mudstone belonging to the Wenlock Shale formation.

Natural ground encountered in BH2, located in the northwest of the site, comprised soft grey silt and clay. Oil contamination was visible during excavation in this area, possibly associated with the nearby underground tanks which are thought to be Victorian inteceptors. It is possible that the organic contamination in this area has caused a change in the composition of the natural ground.

4.2 Groundwater

Groundwater monitoring wells were installed within the Made Ground in all three boreholes.

During the intrusive investigation groundwater was only encountered in BH2 at a depth of 3.0 m bgl, within the Made Ground perched above the clay. During the drilling of the borehole,

visual and olfactory evidence of groundwater contamination was observed, such as discoloured groundwater and an oil like odour.

On 24 July, a groundwater sample was obtained from BH2 using a Waterra pump. Prior to sampling, a maximum of three well volume equivalents were purged, to ensure representative samples were obtained.

Groundwater was not encountered within BH1 and BH3, within the installed monitoring wells.

5. Contamination Assessment

5.1 Soils

5.1.1 Made Ground

The distribution of contamination in soils is statistical in nature and can be assumed to vary spatially across a site. Table 5.1 indicates the range of concentrations for each contaminant found in soil samples from site in the Made Ground, together with the statistical means and standard deviations. In addition, the following screening criteria for the protection of human health in commercial/industrial end use are shown in the table, for reference only:

- Soil Guideline Values (SGVs) published by DEFRA and the Environment Agency, based on the Contaminated Land Exposure Assessment (CLEA) Model;
- Intervention values of the Dutch Ministry of Housing, Spatial Planning and Environment Circular, 2000;
- DEFRA Soil Code (1998).

Table 5.1 Range, Mean and Standard Deviation of Concentrations of Contaminants Detected in the Made Ground

Analyte	Units	Concentration		Mean	Standard Deviation	Screening Criteria	Source
		Minimum	Maximum				
Metals							
Arsenic	mg/kg	9	35	9.2	10.4	500	CLEA SGV
Boron (Water Soluble)	mg/kg	1	12	5.3	3.2	N/A	N/A
Cadmium	mg/kg	2	97	10.6	25.3	1400	CLEA SGV
Chromium	mg/kg	17	149	52	42.4	5000	CLEA SGV
Hexavalent Chrome	mg/kg	0	< 0.3	1.7	1.6	5000	CLEA SGV
Copper	mg/kg	12	271	88.1	72.8	190	Dutch Intervention Level
Lead	mg/kg	7	981	234.1	259.2	750	CLEA SGV
Mercury	mg/kg	< 1	< 1	1	0	480	CLEA SGV
Nickel	mg/kg	10	60	33.8	15.5	5000	CLEA SGV
Selenium	mg/kg	< 1	< 1	1	0	8000	CLEA SGV
Zinc	mg/kg	39	3071	779.3	866.4	300	DEFRA Soil Code

Table 5.1 (continued) Range, Mean and Standard Deviation of Concentrations of Contaminants Detected in the Made Ground

Analyte	Units	Concentration		Mean	Standard Deviation	Screening Criteria	Source
		Minimum	Maximum				
Inorganic Species							
pH Value In Soil	mg/kg	6.74	10.4	7.9	0.9	N/A	N/A
Free Cyanide	mg/kg	< 1	< 1	1	0	20	Dutch Intervention Level
Total Cyanide	mg/kg	9.48	9.48	1.6	2.3	650	Dutch Intervention Level
Thiocyanate	mg/kg	< 1	< 1	1	0	N/A	N/A
Acid Soluble Sulphide	mg/kg	9	1912	207.5	496.7	N/A	N/A
Total Sulphate	mg/kg	1848	5199	3169.1	1210.7	N/A	N/A
Total Sulphur	mg/kg	0.06	0.55	0.2	0.1	N/A	N/A
Organic Compounds							
BTEX							
Ethylbenzene	mg/kg	1	9	2.9	2.8	50	N/A
Toluene	mg/kg	2	13	5	3.7	130	N/A
o-Xylene	mg/kg	1	10	2.9	3.2	25	N/A
p/m-Xylene	mg/kg	2	24	6.9	8	25	N/A
Min. Oil / Paraffin	mg/kg	12	937	191.6	255.7	5000	Dutch Intervention Level
NSO / Resins	mg/kg	26	810	194.5	211	N/A	N/A
Total Phenols	mg/kg	0.01	1.43	0.1	0.4	40	Dutch Intervention Level
PAH							
Total PAH Screen by TLC	mg/kg	11	70	21.5	17.9	40	Dutch Intervention Level
Acenaphthene	µg/kg	< 100	464	N/A		N/A	N/A
Acenaphthylene	µg/kg	< 100	416	N/A		N/A	N/A
Anthracene	µg/kg	< 100	2461	N/A		N/A	N/A
Benzo(a)anthracene	µg/kg	113	265	125.4	61.7	N/A	N/A
Benzo(a)pyrene	µg/kg	183	183	111.9	31.4	35000	CLEA SGV
Benzo(b)fluoranthene	µg/kg	409	409	144.1	116.8	N/A	N/A
Benzo(ghi)perylene	µg/kg	< 100	659	N/A		N/A	N/A
Benzo(k)fluoranthene	µg/kg	149	149	107	18.5	N/A	N/A
Chrysene	µg/kg	124	390	144.9	108.5	N/A	N/A

Table 5.1 (continued) Range, Mean and Standard Deviation of Concentrations of Contaminants Detected in the Made Ground

Analyte	Units	Concentration Minimum	Maximum	Mean	Standard Deviation	Screening Criteria	Source
Dibenzo(a,h)anthracene	µg/kg	<100	185	N/A		N/A	N/A
Fluorene	µg/kg	< 100	1755	N/A		N/A	N/A
Fluoranthene	µg/kg	174	484	165.4	143.2	N/A	N/A
Indeno(1,2,3-cd)pyrene	µg/kg	< 100	423	N/A		N/A	N/A
Naphthalene	µg/kg	< 100	246	N/A		N/A	N/A
Phenanthrene	µg/kg	110	393	150.7	108.5	N/A	N/A
Pyrene	µg/kg	110	402	144.6	113.6	N/A	N/A
Phthalates						60	Dutch Intervention Value
Bis(2-ethylhexyl) phthalate	mg/kg	437	664	228.7	229.4		N/A
Di-n-butyl phthalate	mg/kg	301	497	279	177.3		N/A
Solvent Extractable Matter	mg/kg	48	1336	405.6	409.2	N/A	N/A
Dioxins			**Results not available**				
Asbestos Presence Screen	**%**		**No Fibres Detected**				

Statistical calculations assume that if compounds are not detected, they are present at a concentration equal to the limit of detection.

< = Less than, N/A = Not Applicable

5.1.2 Natural Ground

A total of 3 natural ground samples were analysed.

Toxic Metals

Arsenic was not detected in any of the samples in which it was determined.

Cadmium concentrations ranged from below the detection limit (1 mg/kg) to 1 mg/kg.

Chromium concentrations ranged from 29 mg/kg to 34 mg/kg.

Hexavalent chromium was not detected in any of the samples in which it was determined.

Lead concentrations ranged from 7 mg/kg to 39 mg/kg.

Mercury was not detected in any of the samples in which it was determined.

Nickel concentrations ranged from 51 mg/kg to 75 mg/kg.

Selenium was not detected in any of the samples in which it was determined.

Phytotoxic Metals

Boron concentrations ranged from 2 mg/kg to 14 mg/kg.

Copper concentrations ranged from 27 mg/kg to 36 mg/kg.

Zinc concentrations ranged from 80 mg/kg to 464 mg/kg. One sample exceeded the DEFRA Soil Code value of 300 mg/kg.

Inorganics
pH concentrations ranged from 7.57 to 8.12, indicative of neutral to slightly alkaline conditions.

Free cyanide was not detected in any of the samples in which it was determined.

Thiocyanate was not detected in any of the samples in which it was determined.

Total sulphate concentrations ranged from 566 mg/kg to 1227 mg/kg.

Total sulphur concentrations ranged from below the detection limit of 0.01% to 0.12%.

Organics
Total PAH concentrations ranged from below the detection limit (10 mg/kg) to 48 mg/kg. We note that one sample exceeded the Dutch Intervention Value of 40 mg/kg.

Total phenol concentrations ranged from below the detection limit of (0.01 mg/kg) to 0.04 mg/kg, well below the Dutch Intervention Value of 40 mg/kg.

VOCs and SVOCs were generally below detection limits, except for:

- Trace PAHs, including phenanthrene, fluoranthene and pyrene in BH2;
- trace concentrations of phthalates, including di-n-butyl phthalate, di-n-octyl phthalate, bis(2-ethylhexyl)phthalate and butylbenzyl phthalate detected in BH2. The total concentration of phthalate was well below the Dutch Intervention Value of 60 mg/kg for total phthalate.

5.1.3 Summary of Soil Contamination

The majority of determinands in the Made Ground were detected at levels below their screening criteria, with the exception of zinc, which was observed at elevated concentrations across the entire site. Elevated concentrations of PAHs were detected at three locations. One slightly elevated copper concentration was detected.

In general, the natural ground was determined to be uncontaminated, with the exception of the natural ground in the north west of the site. At this location the concentration of zinc exceeded the guideline value and the concentration of total PAH exceeded the Dutch Intervention Value. This corresponds with visual and olfactory evidence of contamination.

The only area of significant contamination at the site is the area surrounding BH 2, in the north west of the site. The elevated organic contamination (PAHs and phthalates) in the area is possibly due to contamination migrating from the Victorian interceptors, which are no longer used however, the exact source and extent of the contamination is unknown.

5.2 Groundwater Chemistry

Groundwater was only encountered in BH 2 at a depth of 3.00 m bgl, which was sampled on 23 July. Groundwater sampled from BH 2 was visibly contaminated. A review of groundwater chemistry is given below. The laboratory certificates are presented in Appendix K.

5.2.1 Metals

Cadmium, copper and mercury were not detected.

Arsenic, boron, chromium, lead, nickel, selenium and zinc were all detected at concentrations, which exceeded the screening criteria. Extremely elevated concentrations of boron and zinc were detected in the groundwater sample.

5.2.2 Inorganics

pH was 7.6, indicative of neutral conditions.

The concentration of total cyanide was 0.86 mg/l.

Total soluble sulphate concentration was 82 mg/l.

5.2.3 Organics

Total phenols were not detected.

VOCs and SVOCs were not detected.

5.2.4 Summary of Groundwater Contamination

Groundwater was only encountered in one location at the site. The groundwater encountered in BH 2 was visibly contaminated and the results of the chemical analysis reflect this observation. Elevated levels of metals, specifically zinc and boron were detected in the groundwater sample.

5.3 Leachate Analysis

Five samples of Made Ground were submitted for leaching tests. The laboratory certificates are presented in Appendix K. A review of soil leachate chemistry is given below.

5.3.1 Toxic Metals

Arsenic concentrations ranged from 1 to 4 μg/l.

Cadmium was not detected in any of the samples in which it was determined.

Chromium concentrations ranged from 4 to 19 μg/l.

Lead concentrations ranged from 1 to 5 μg/l.

Mercury was not detected in any of the samples in which it was determined.

Nickel concentrations ranged from 1 to 2 μg/l.

Selenium concentrations ranged from 1 to 3 μg/l.

5.3.2 Phytotoxic Metals

Boron concentrations ranged from below the limit of detection (10 mg/l) to 114 mg/l.

Copper concentrations ranged from below the limit of detection (1 μg/l) to 8 μg/l.

Zinc concentrations ranged from 16 to 24 μg/l.

5.3.3 Inorganics

pH ranged from 7.4 to 8.0, indicative of neutral to slightly alkaline conditions.

Total cyanide was not detected in any of the samples in which it was determined.

Sulphate concentrations ranged from below the limit of detection (3.0 g/l) to 30 g/l.

Sulphide and free sulphur was not detected in any of the samples in which it was determined.

5.3.4 Organics

Total phenol was not detected in any of the samples in which it was determined.

5.3.5 Summary of Leachate Analysis

No determinands exceeded the Dutch 'I' values.

The results of the leaching tests indicate that metals, inorganic and inorganic contaminants in the soil are generally not in a leachable form, with the exception of boron, which was detected at elevated concentrations.

6. Conceptual Model

6.1 Initial Conceptual Site Model (CSM)

This section assesses the potential contamination associated with the site and both the current and historical operations undertaken on it. In order to ascertain whether substances in, on or under the land constitute a pollution risk, this section considers the various **source - pathway - receptor** linkages that can exist on the site which can be further described as:

- the **source** of the contaminative agent;
- the **pathway** by which the contaminative agent could come into contact with a receptor;
- the characteristics and sensitivity of the **receptor** that is viewed as being vulnerable.

The interplay of the various pollution linkages is referred to as a 'Conceptual Model' as required by Schedule 4 of the PPC regulations. The purpose of the assessment is to establish the baseline or the need for further site investigations to confirm the baseline land condition.

6.2 Conceptual Ground Model

The majority of the site is covered with a layer of hardstanding, comprising concrete to a depth of approximately 0.20 m bgl. The entire site is underlain by foundry sand ranging in thickness from 9.0 m in the south of the site to approximately 7.0 m thick in the north of the site.

Figure 6.1 comprises a cross section (north to south) illustrating the strata encountered during the intrusive investigation.

6.3 Summary of Contamination Sources and Chemicals of Concern (COC)

On the basis of the information obtained to date, several potential contamination sources have been identified associated with the former and current usage of the installation area.

Potential contaminant sources identified in the Phase 1a and Phase 2 investigations are summarised in Table 6.1.

Table 6.1 Contamination Sources and Chemicals of Concern

Area	COC	Available Recorded Concentrations	Further Assessment Recommended
All areas	Zinc	Y	N
Area A and D	Total PAH	Y	N
Area B	Total PAH	Y	N

The principal contamination issues in each Area on site are set out below.

6.3.1 All Areas

Elevated zinc concentrations were observed across the whole site, up to ten times the soil guideline value. As elevated zinc was detected across the entire area of the site, it is possible that it is associated with the raw materials including scrap metal used in the foundry process, maintenance materials, old patterns and castings and former railway.

6.3.2 Area A

An elevated total PAH concentration was detected in the south of the site. The possible source of this contamination is the former railway sidings, which occupied the site during the late 19th and early 20th century. Alternatively, the elevated PAH concentrations may be due to the presence of foundry sands beneath the site. No requirement exists to further assess this contamination as it can be attributed to historical activities at the site and is unlikely to worsen.

6.3.3 Area B

It is likely that the elevated total PAH concentrations detected in this zone are associated with the red brick underground tanks, thought to be Victorian interceptors.

As this contamination can be attributed to an historical source and will not be contributed to by current processes there is no requirement, with regard to PPC, to undertake further assessment.

6.3.4 Area D

Slightly elevated PAH concentration was detected at one location in the east of the site, possibly associated with former railway sidings, foundry sand or resulting from the use of lacquers, resins, thinners and lubricants at the site.

No requirement exist under PPC to further assess this contamination as it can be attributed to historical activities at the site and is unlikely to worsen.

6.3.5 Pathways

The majority of the site is covered with thick concrete, therefore, direct contact with, and ingestion of, contaminated soil is unlikely. The potential for inhalation of vapours and dusts exists in some areas of the site.

It is unlikely that surface water will migrate through the underlying soil transporting contaminants to groundwater, as the majority of the site is covered with hardstanding and pollution prevention measures, which acts as a barrier to the leaching of contaminants from the surface.

Surface waters, which collect on external hardstanding areas are captured by surface water drains and directed to the Lyde Brook. Therefore, any surface contaminants will be transported in the drainage system. Internally, effluent from site amenities is directed to a foul sewer.

6.3.6 Receptors

Identified controlled water receptors in this initial conceptual model comprises groundwater beneath the site and the surface water of Lyde Brook, which is a tributary of the River Severn.

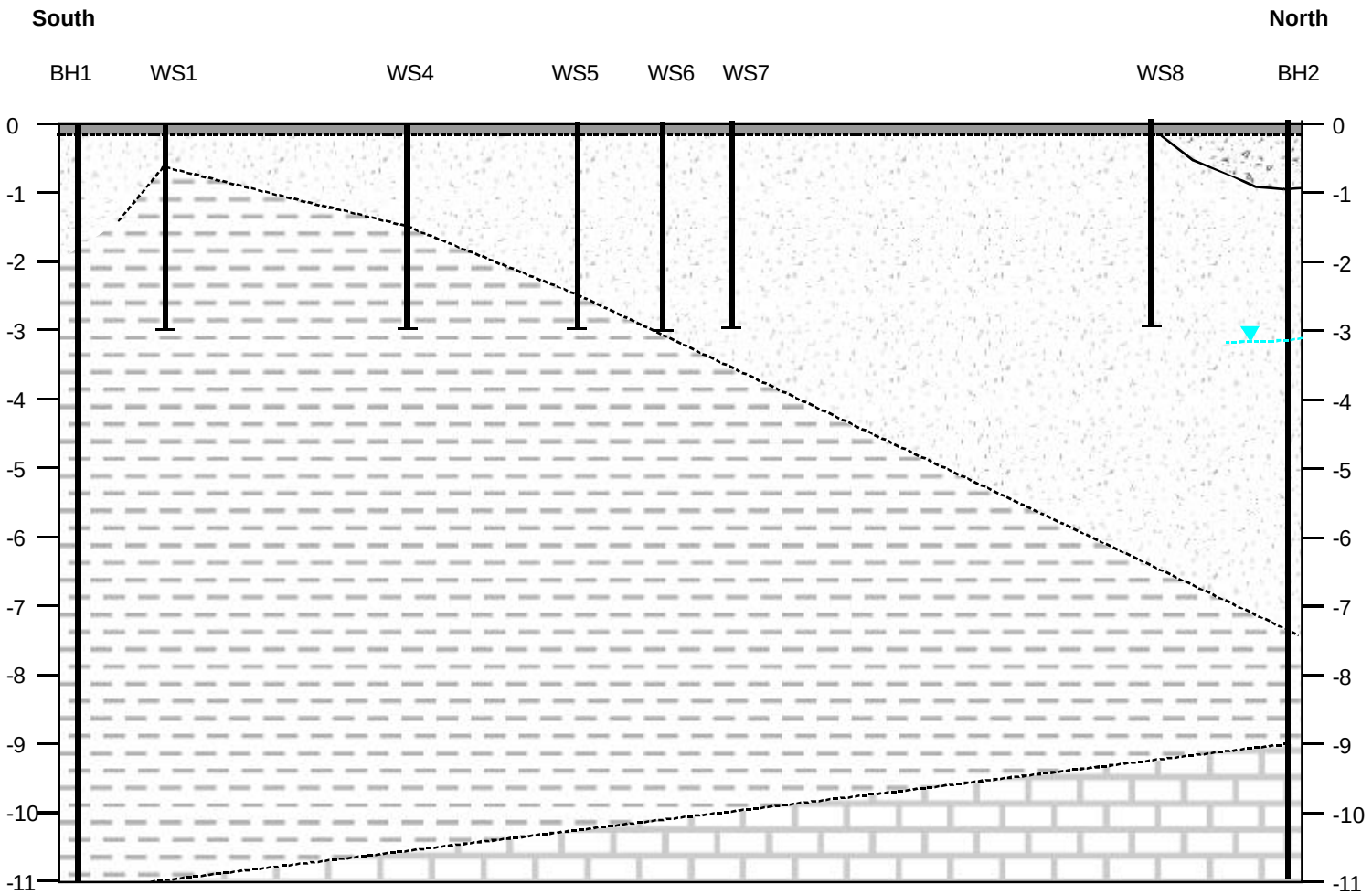
During the ground investigation, perched groundwater was encountered in the north west of the site. However, the ground investigation indicated that groundwater is unlikely to be present in significant quantities beneath the site due to the impermeable strata and the underlying Wenlock Shales, which is classified as a non aquifer.

During the site investigation it was apparent that the natural ground in the area near to BH 2 had been impacted by organic contamination. It is possible that this has caused a change in the composition of the clay, possibly increasing its permeability. Therefore, it is likely that the underlying Whenlock Shale has limited protection from migration of contamination. However, the shale is classified as a non aquifer and has low permeability, therefore, the risk of contaminant migration is low.

Human receptors comprise workers at the site, including construction workforce during site maintenance and redevelopment, visitors to the site as well as other workers in the surrounding area. Trespassers have not been considered as potential receptors as access to the site is restricted.

Flora and fauna should also be considered as receptors, particularly aquatic species in the adjacent stream. The majority of the site is hardstanding, except a small area in the south and along the western boundary of the site, where the quality of the vegetation is poor due to the underlying foundry sands.

Buildings and buried services are potential receptors as in some areas of the site the ground conditions encountered appear to constitute a hostile chemical environment.



Key

- Concrete
- Ashy Gravel
- Foundry Sand
- Clay (Weathered bedrock)
- Bedrock(Wenlock Shale)
- Groundwater level

0 m — 50 m

Scale1:1,000@A4
10xVerticalexaggeration

Aga Rayburn, Coalbrookdale
Phase 2, Site Investigation (PPC)

Figure 6.1
Conceptual Cross Section

August 2003
10499-S10.cdr barkr

Entec

7. Conclusions

7.1 Summary of Current Site Condition

During the Phase 1, the site appeared to be in good order, although housekeeping was poor in external areas. The only visual evidence of contamination was on the area of open ground in the south of the site in the vicinity of the oil tank in the south. Internally, visual staining of floor surfaces was observed but could generally be attributed to staining by coal dust within the foundry sand.

Several areas were identified during the Phase 1 as requiring further investigation, as outlined below:

- former landfill for foundry sand and miscellaneous site waste beneath the car park and the southern corner of the installation area (Zone A);
- dioxins within ground adjacent to cupolas (Zone B);
- hydrocarbon contamination from spillages of diesel and oil (Zone A);
- historical and current use of solvent based products (Zones A, B, C and D);
- storage of miscellaneous materials on open ground in external areas within the installation (Zones A, B and D).

All operational, process areas and the majority of storage areas within the application boundary are founded on hardstanding or within bunds. Any spills in external areas, covered with hardstanding, are drained by the in the surface drainage system which is discharged to the Lyde Brook. The condition of the drainage system is unknown.

Cooling water used in the main process building is also collected by the surface water drainage system. Contaminants are only likely to impact on this cooling water if there is a mechanical failure of plant machinery, resulting in the leakage of oil or lubricants.

Effluents generated (dust and treatment water) from the site processes are collected via the extraction system and removed offsite.

In areas where there is no external hardstanding (Zone A) spills will seep into the foundry sands that underlie the whole of the site and pass via soakaways into the Lyde Brook. In these areas, where inadequate bunding is present further control measures should be adopted to prevent changes in the site condition.

The Phase 2 investigation focussed on the areas previously identified as requiring further investigation within the Phase 1a study. The ground investigation indicated that the north west of the site is an area of concern. Elevated total PAH concentrations were detected in the Made Ground and natural ground and the highest SVOC and VOC concentrations were detected in the Made Ground sampled in this location. This was the only area of the site where groundwater was encountered. Chemical analysis of the groundwater sample indicated elevated determinands over their respective assessment criteria. It is thought that the

contamination in this area is attributed to contamination seeping from the Victorian interceptors in this area.

Elevated zinc concentrations were detected in the underlying foundry sands across the entire site. The results of the leaching tests indicate that the zinc in the soil is not in a leachable form. However, leachate analysis did indicate that, although water soluble boron in the soil is present in relatively low concentrations, it is highly leachable.

Appendix A
Completed Entec Questionnaire

6 Pages

Appendix B
Site Photographs

4 Pages

Appendix C
BGS Boreholes

19 Pages

Appendix D
Extracts and Drawings from Coalbrookdale Watercourse Project

41 Pages and 1 Plan

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Appendix E
Historical Maps

12 Pages

Appendix F
Extracts from Geotechnical Investigation

8 Pages

Appendix G
Envirocheck Report

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Appendix H
List of Chemicals Used

2 Pages

Appendix I
Utilities Information

X Pages

Appendix J
Borehole and Window Sample Records

X Pages

Appendix K
Certificate of Analyses

X Pages