

**REPORT OF AN ENVIRONMENTAL SITE
SURVEY OF THE MONCKTON COKE
AND CHEMICALS WORK**

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CONTENTS

	Page
1. EXECUTIVE SUMMARY	3
2. INTRODUCTION	5
3. FACILITY DESCRIPTION	5
3.1 Site	6
3.2 Environmental Setting	7
3.3 Operations	9
3.4 Pollution Control Equipment	12
4. INFORMATION GATHERING FOR ASSESSMENT	14
5. ASSESSMENT	15
5.1 Coal and Coke Storage and Handling	15
5.2 Hazardous Material Storage and Treatment	16
5.3 Solid Waste Management	18
5.4 Water Management	19
5.5 Air Emissions	21
5.6 Soil and Groundwater Assessment	26
5.7 Safety Issues	32
5.8 Emergency Planning and Response	34
5.9 Other Areas	35
6. COMPLETED AND PLANNED ENVIRONMENTAL IMPROVEMENTS	39
7. CONCLUSIONS AND RECOMMENDATIONS	46

1. EXECUTIVE SUMMARY

This report describes an Environmental Site Survey (ESS) of the Monckton Coke and Chemicals (MCC) works, Royston near Barnsley. The survey included the following:

- an examination of the site's history from historical maps and records.
- examination of consent conditions for effluent discharge, process authorisations and waste disposal licences and consignment notes.
- examination of geological and hydrogeological maps.
- analysis of monitoring data, drainage plans and site plans
- discussions with regulatory bodies
- a site visit to observe operations and site conditions

As part of the process authorisation issued by Her Majesty's Inspectorate of Pollution (HMIP) in December 1993 (Variation AI9419) MCC are required to undertake a number of improvement works and environmental assessments. In addition, MCC have also planned a programme of improvements which was submitted with their original application for authorisation to HMIP. MCC have already completed some of these actions and improvements and these are listed in section 6 of the report. Actions and improvements still to be completed are also listed in section 6 and broad estimates of their costs provided. There was insufficient time to obtain accurate cost estimates and it is recommended that further work is undertaken to obtain these estimates.

The ESS identified a number of areas for concern on site and Moorehead Consulting's recommendations are summarised in the table in section 7. The ESS showed that the site is contaminated, probably with oils, constituents of tar and phenols. No site investigations have been undertaken and, therefore, the type of contamination, the concentrations of contaminants and their rate of migration off site are not known.

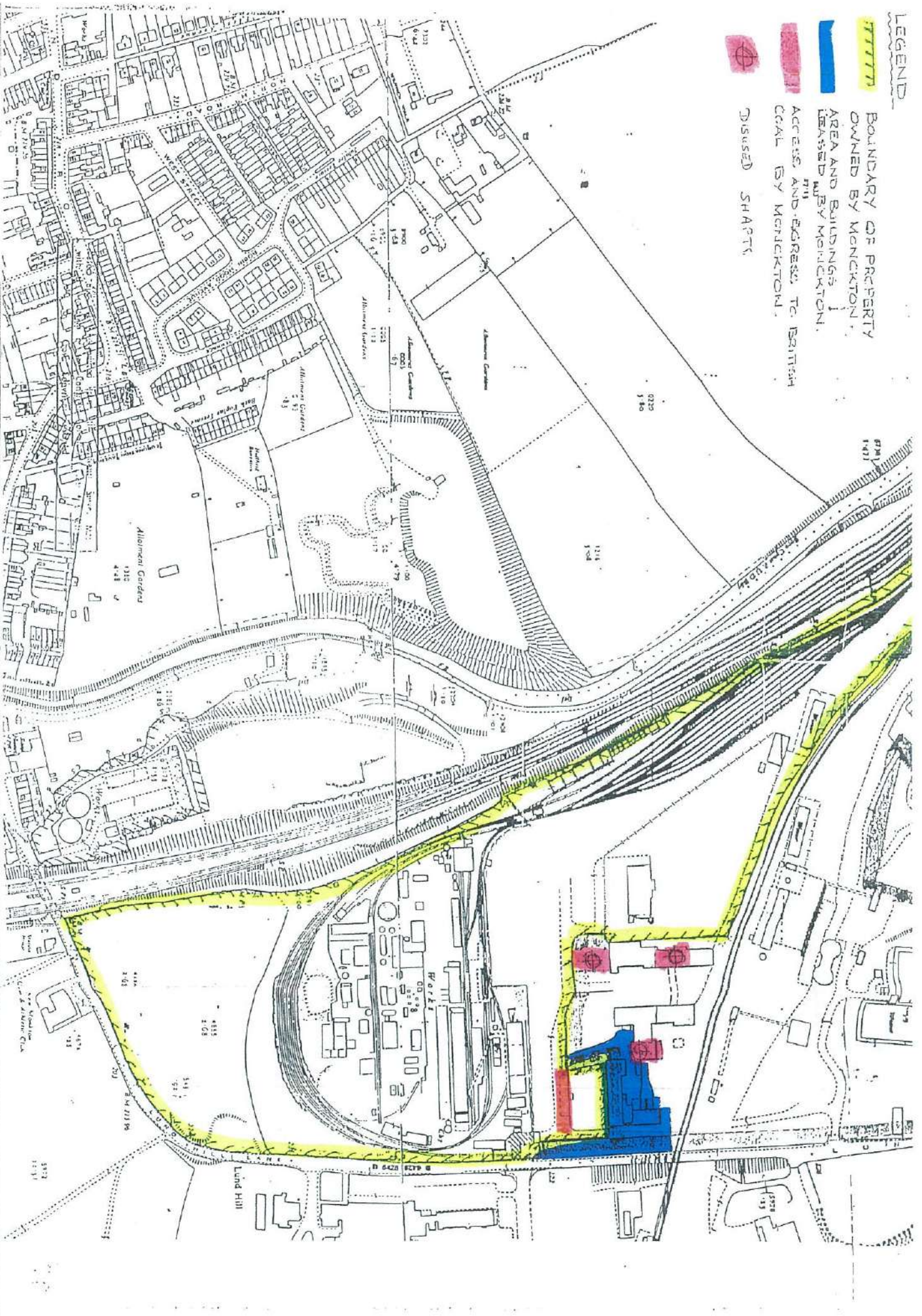
There was much visual evidence of contaminants having penetrated the soil, migrating to underground sumps and leaching out from the sandstone escarpment on the Western boundary of the site, adjacent to the railway line. This leachate is now being collected in a slotted pipe, transferred to a sump and pumped to the Biological Effluent Treatment plant. Surface water run off and drainage appears to be flowing into the old Aire and Calder canal. There was visual evidence of the surface water picking up contaminants and transporting them off site.

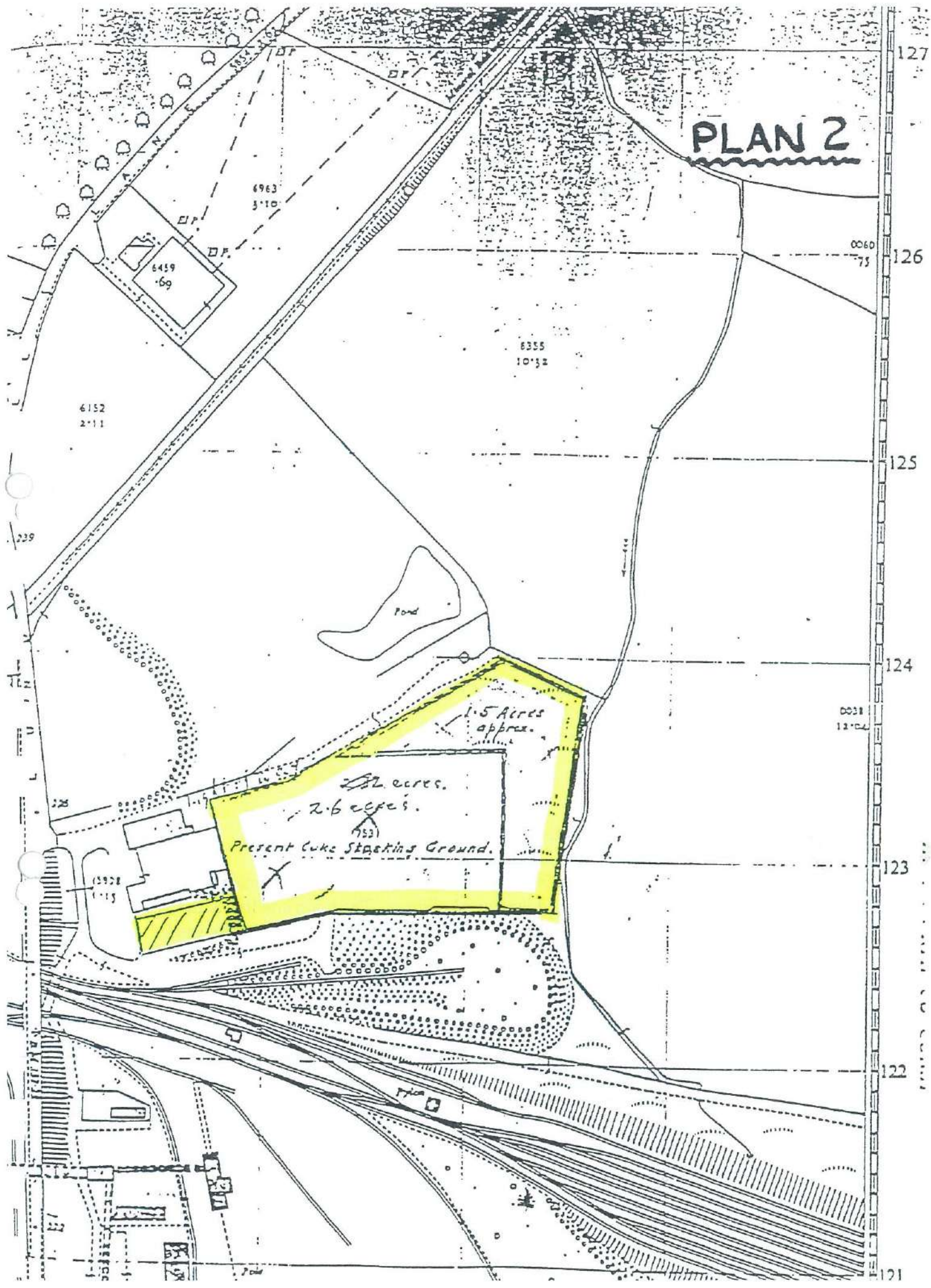
Furthermore, the plant will need to be brought up to new plant emission standards by 1/4/98. Sulphur dioxide emissions will need to be reduced through the use of low sulphur coals and the installation of desulphurisation equipment. The installation of desulphurisation equipment may involve the company in substantial capital costs and it is recommended that research into options is conducted at the earliest opportunity.

LEGEND



BOUNDARY OF PROPERTY
OWNED BY MONCKTON.
AREA AND BUILDINGS
LEASED BY MONCKTON.
ACCESS AND EGRESS TO BRITISH
COAL BY MONCKTON.
DISUSED SHAFTS





vicinity of the property. Three shafts are located within the site boundary but still owned by British Coal (figure 2.1). The shafts have been filled to the surface and Shafts 1 and 2 have also been capped.

A map search shows that there was no colliery in operation in the 1850s and there was a sandstone quarry to the East of the site. The colliery was clearly in operation by the 1890s and the Winterset reservoir, about 3 Km North of the site, had been constructed. By 1908 the colliery had expanded

and there was a spoil tip and quarry between the railway and canal where the current gas plant is located. There was also one gasometer at this location indicating that coke production had already begun. In fact, coke has been manufactured on the site continuously since 1879. By 1930 a brickworks was in operation to the North of the mineral railway line with a clay pit on the opposite side of Lund Hill Lane (figure 3.1). The mine water reservoirs and a well were located next to the brickworks. The clay pit had expanded by 1950 indicating that the brickworks were still in operation but they ceased to exist by 1960. By 1930 there were two gasometers between the railway line and canal. The spoil heaps to the South East and North of the site expanded considerably between 1900 and 1950. The large spoil heap to the SE covered one of the dykes flowing SW which formed a lagoon to the North of the spoil heap. This lagoon has now been removed. By 1960 some of the extensive railway sidings had been removed and a works had been constructed next to the gasometers indicating that the gas was being cleaned. At about this time a new water well appears just to the North of Royston, adjacent to garden allotments. Most of the railway sidings had been dismantled by 1980, the spoil tip to the North had been reclaimed and the only active workings were a drift mine to the East of Lund Hill Lane. The most recent survey (figure 3.2) shows the extent of the spoil heaps to the East, SE and SSE of the site and the lagoon is also shown to the North of the largest spoil tip. The extent of the works is shown including the 2 gasometers and gas purification plant.

3.2 Environmental Setting

Location

The site lies about 25Km North of the city of Sheffield and about 7 Km NE of Barnsley. The nearest centre of population is the village of Royston, 1Km to the West of the site.

Hydrology

The site lies about 60 metres above sea level with an average annual rainfall of about 650mm per year. It is located between the rivers Calder to the North and Dearne to the South, which drain to the East. The Cold Hiendley and Winterset reservoirs lie about 3 Km to the North of the site. The main surface water flow in the vicinity of the site is from NE to SW

3.3 Operations

The plant operates 365 days per year and 24 hours per day in a 4 shift system.

The process involves the production of industrial and domestic coke and related by-products from the carbonisation of coal. The main process can be divided into:

- Coal handling
- Carbonisation
- Coke handling
- By-products separation
- Gas purification
- Auxiliary boiler plant
- Biological effluent treatment

Figure 3.3 gives a block flow diagram of the process.

Coal handling - Coal is delivered by road and stored in one of three concrete-floored bays. There are approximately 100, 20 tonne lorry movements per day (i.e. for coal delivery, coke and by-product transport from the site). The coal is lifted from stock by mechanical shovel and conveyed to a 1300 tonne storage bunker. From here the coal is conveyed to a 500 tonne bunker located over the coke ovens. Coal is gravity discharged from this bunker into the oven charge car.

Carbonisation - Carbonisation is the thermal process for the conversion of coal into coke, involving heating coal at high temperature for many hours, in the absence of air, whilst contained in ovens. A battery comprises many ovens, each oven being heated indirectly by heat transferred through its refractory walls from flues on each long wall, in which coal gas is burnt under controlled conditions in air. Coal gas used is a portion of that evolved from the coal during its carbonisation and after purification. Air for combustion is drawn into the battery heating system, where it is heated by passing through flues in which gas was earlier burnt, then the preheated air is introduced into individual heating flues to support combustion of gas provided through jets. The gas burning and air preheating procedure in flues operates on a cyclic basis in which some flues are burning gas and others are giving up their heat to incoming combustion air.

Combustion gases are drawn from the oven heating flues through adjacent flues for heat recovery and are then discharged continuously to atmosphere from the battery chimney. A daub mill is utilised to produce the daub for sealing the coke oven doors. The mill consists of two heavy rotating

having an ammonia still, a dephlegmator and a condenser. Caustic soda is added to the upper section of the ammonia stills to strip the free ammonia and sulphides from the liquor. Caustic soda is stored in a tank on site. All remaining liquor is transferred to the biological effluent treatment plant prior to discharge to sewer. The effluent from the stills is regularly checked to determine the amount of free ammonia in the effluent. If the effluent is off-specification (i.e. >150ppm free ammonia) it is sent to the off-specification CAL tank and re-treated.

The coke oven gas, free of ammonia, is passed through two packed towers through which oil is continuously pumped. The benzole absorbing oil comprises naphthalene and its derivatives, diphenyl, dibenzofuran and fluorene. The oil removes the benzole (a mixture of benzene, toluene and xylene) from the gas stream. The benzole is then recovered from the oil by steam distillation and stored prior to despatch off-site for sale. The oil is cooled and recirculated in the scrubbing towers.

A portion of the now de-benzolised gas is returned to the battery for fuel and also to the auxiliary steam-raising boilers. The remainder is either despatched off-site for sale or stored in the plant's gas holder. The gas holder, capacity 1400 m³, allows for fluctuations in gas production. Any excess gas which cannot be sold is routed to a flare stack.

Gas purification - Crude coke oven gas contains hydrogen sulphide which is produced from sulphur in the coal. The hydrogen sulphide is removed from the gas sold by passing it through a series of boxes containing solid iron oxide. The desulphurised gas is then pumped off-site via a pipeline for sale to industrial users. After a period of time, the iron oxide becomes saturated and is removed from the boxes and disposed of to landfill.

Auxiliary boiler plant - Steam for use on site is produced by burning undesulphurised coke oven gas in three boilers, producing 18,000 kg/hour steam at 7 bar gauge pressure.

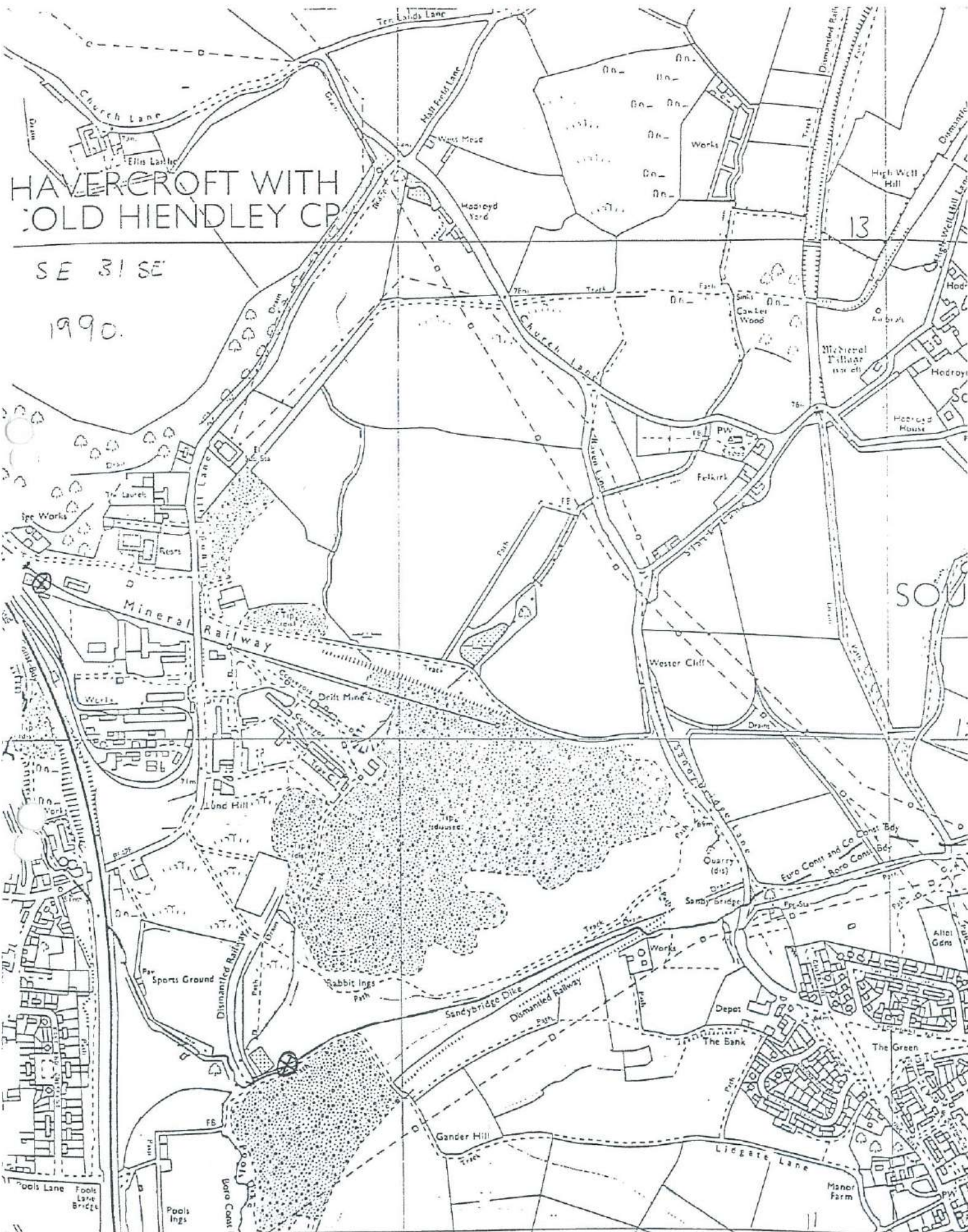
Biological effluent treatment (BET) - Liquor and general process drainage is collected and treated prior to discharge to sewer. Currently the BET plant also treats water from a sump placed in the Lineside Dyke on the western boundary of the site. The treatment consists of mixing the effluent with biological sludge and then feeding oxygen to oxidise the polluting organic compounds to carbon dioxide. After a residence time of 24 hours, the effluent is removed from the oxidisers, the sludge is allowed to settle out and the clarified liquor is discharged to sewer.

Cooling water is used in the closed circuit system, cooled by a number of forced draught coolers. A continuous purge is currently discharged to controlled waters and made up from water pumped from the site reservoir which is fed by mines drainage or from canal.

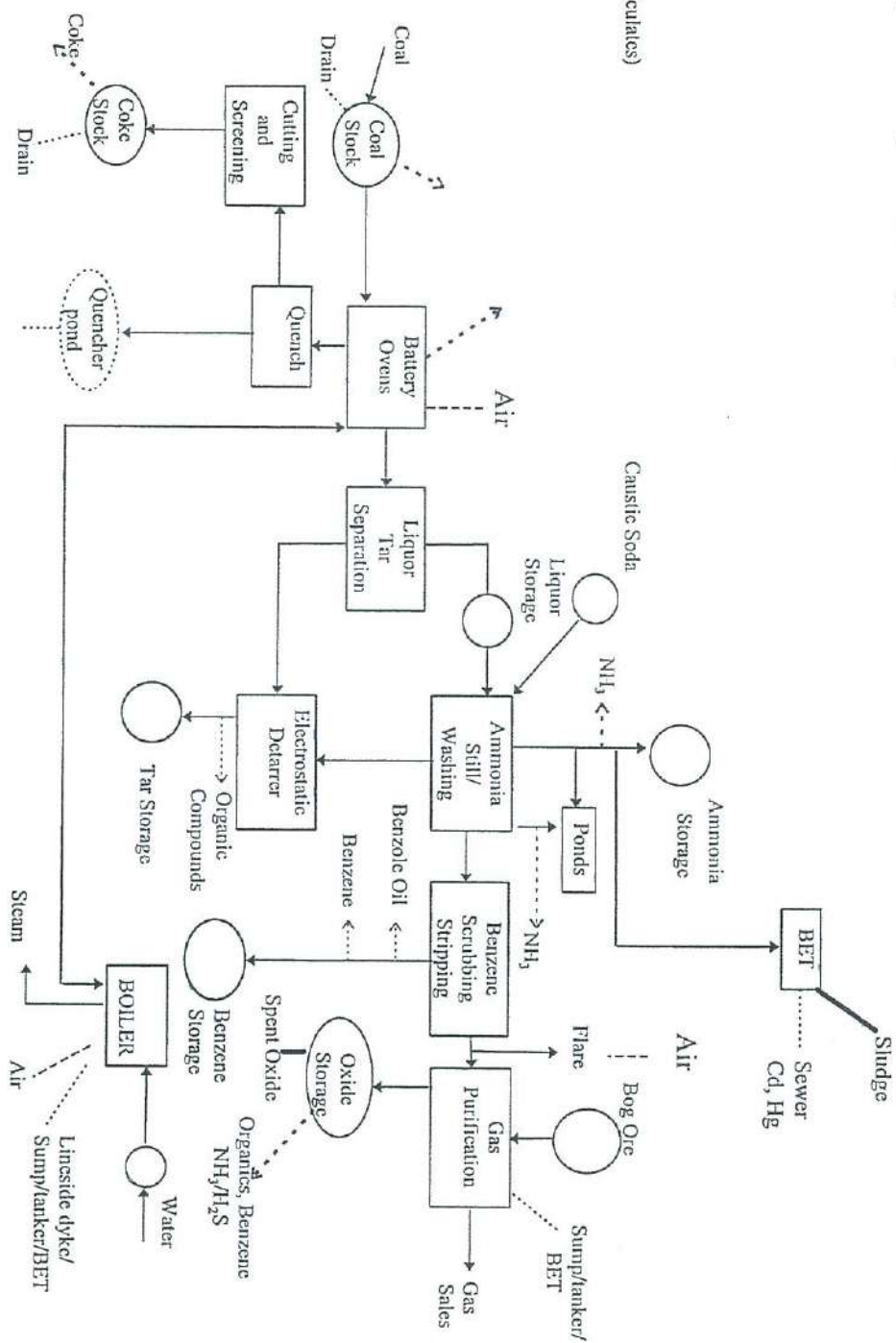
Surface drain no. 5 (see figure 3.5) flows down the Eastern and Northern boundaries of the site and discharges to the Aire and Calder canal. This discharge is not consented. Foul water drain No. 8 (see figure 3.5) flows North to the Monckton sewage works.

The gas for sale is desulphurised by passing it through boxes containing iron oxide. The spent iron oxide is disposed to landfill (see section 3.3).

The crude benzole tanks, caustic soda tank and concentrated ammonia liquor sales tank are all bunded. The new liquor drains tank, benzolized oil tank and new tar drains tank are contained in a below-ground sump. Other underground storage tanks have been removed or are in the process of being removed.

[illegible]

	Store
	Process operation
	Fugitive emissions
	Air emission (SO _x , NO _x , CO ₂ , CO, particulates)
	Land disposal
	Drain/Effluent emission



4. INFORMATION GATHERING FOR ASSESSMENT

An environmental audit questionnaire was sent to MCC for completion prior to the site visit. A copy is given in Appendix 1. The following source documents were used to gather information on the site and on pollution emissions and control:

- HMIP authorisation and application for a revision (Appendix XII)
- Application to HMIP for authorisation (Appendix IX)
- NRA abstraction license
- NRA discharge consent and monitoring results (Appendix II)
- Yorkshire Water (YW) discharge consent (Appendix III)
- Monitoring results from MCC (Appendix IV)
- Hydrogeological and geological maps
- Groundwater information from NRA

In discussion with key staff at the site the following information was requested and received.

- Monitoring results for cyclohexane soluble materials (CSM)
- Monitoring results for polychlorinated biphenols (PCB)
- Clarification of surface water drainage on site
- Control of Substances Hazardous to Health (COSHH) assessments
- Reports of pipeline inspection
- Noise monitoring results
- Effluent monitoring results from YW
- Canal and mines water analysis
- Monthly returns to HMIP on monitoring of emissions to air, sewer and controlled waters
- Emergency plans
- Off-site monitoring for smoke and SO₂
- Record of complaints
- Waste consignment note and waste records.

The ESS took place over the period 11-13th January 1994. The ESS team were accompanied by Dr Phil Roberts, Martyn Brown and Simon Miller.

parts of the site. Five of these pumps are for benzole or benzole rich oil circulation, and are due to be replaced.

The three crude benzole product tanks are of 34m³ capacity each and are in a bunded area (D, figure 5.1). Two new tanks are in the process of being installed, to replace these. It was observed that the current tanks were all open to vent to atmosphere, through their "dip points". This will allow the volatile liquor to escape.

5.2.3 Ammonia System

A pressure gauge on the side of Still B was observed to be leaking liquor onto the ground (E, figure 5.1).

Before passing through the new heat exchangers, the hot effluent goes into a storage tank. This tank was open to the atmosphere and a contaminated steam vapour was emanating from a 15cm pipe on top of the tank (F, figure 5.1). This was allowing organic materials to be stripped off to air. In addition the CAL plant was not well bunded, particularly since it was on the edge of a slope.

The three liquor storage tanks and the offspec CAL tank were inspected. There was no bunding around these vessels and there was a distinct smell of ammonia in the area from the sample points. A tar runoff line comes from the tanks and there was evidence on the ground of previous tar spills, possibly from the open inspection points (G, figure 5.1 and photograph, figure 5.12).

It is recommended that bunding is provided around all storage tanks, the benzole plant pumps and the CAL plant.

5.3 Solid Waste Management

There is no official on-site disposal facility. There are a number of areas on site where old machinery, such as pumps, pipework, bricks and other general inert waste are dumped or are remnants from previous operations. The waste is generally inert and does not pose a health or environmental threat. However, as part of general house keeping it is recommended that such waste should be removed from site.

Spent iron oxide from the gas purification plant is discharged from the five overhead boxes onto a concrete base at ground level. Each box contains 180te of oxide and is discharged once per year. The oxide is then transferred into covered containers for disposal to landfill by the local authority. The spent oxide is considered a special waste because of its high sulphur content. Its storage and removal from site is covered by Waste Disposal Licence No. 815 granted by the West Yorkshire Waste Management Committee. Up to 250 tonnes of waste may be held at any

The data also shows the presence of phenols, a consented parameter, in the aeration tanks. It is recommended that phenols are measured regularly at effluent discharge and also in the sump placed within the Lineside Dyke.

There was a definite odour of volatile organics emanating from the final settling tank and the discharge channel to sewer was frothing and spilling out of the channel (photograph, figure 5.2). This can be controlled by use of anti-frothing agents.

Process water for the site is abstracted, under licence, from the canal and from mine waters and stored in a reservoir on site. The licences allow up to 188 m³/hr to be abstracted and water use is well within this rate. The water is used via a ring main for quencher water, cooling water system make-up and BET plant dilution. Plant modifications redirects excess quencher water back to the quencher pond. It is unlikely that the quantity of process water used on site can be reduced substantially without major plant modifications.

Drainage from the coal and coke stock areas (drain no. 5, figure 3.5) discharges to the canal. During the site visit there was a leak from the cooling towers which flowed West down the by products tanker loading road and then North, along the Western boundary of the site, through the edge of the coke stock area. Whilst it was not possible to follow this run-off beyond the site boundary it is clear that it would end up in the canal. On its route to the canal the run-off picked up oil from the site indicated by the oily sheen on the surface of the water (H, figure 3.5 and photograph, figure 5.3): Further site analysis would reveal the nature of the contamination but it may contain benzole absorbing oil, principally naphthalene, benzene and the more mobile fractions of tar. Benzene is a known carcinogen and naphthalene a skin irritant. Phenols are also likely to be present. Contamination from the site is discussed in more detail in section 5.6.

As mentioned in section 5.1, acid rain is likely to leach out heavy metals from coal and coke stocks which will also find its way via run off and groundwater into the canal.

As mentioned earlier, MCC plan to import coal into the site by rail. The plan includes the purchase of Local Authority land to the North of the mineral railway branch line for coal storage. Under this plan it is recommended that a hard standing area for the coal is constructed and that the area is drained, the drain water collected and either used for process water or sent to sewer.

It is also recommended that site drainage and run-off collection is re-planned for the whole site. This would require the construction of hard standing, particularly in the by product production and storage area and the coke storage area. Drains and run off collection should be designed for

Door Leakage Control Factor (DLCF)	92%
Tops Leakage Control Factor (TLCF)	96%
Charging Emission Factor (MEF)	To be advised by HMIP
Pushing Emission Factor (PEF)	To be advised by HMIP

The requirements for TLCF will be tightened to 98% on 1 April 1996. These parameters are visually measured regularly and the results reported to the HMIP monthly. Examination of the 1993 results showed 100% compliance and a steadily improving performance, due mainly to closer operational controls.

5.5.3 Battery Stack

The waste gases from all the coke oven heating walls are collected in the waste gas flue and are emitted to atmosphere via the battery stack. This waste gas stream contains NO_x , SO_x , CO and CO_2 . The flow rate and composition of the gas has been derived by calculation and CO_2 measurements.

The IPC Authorisation sets both maximum concentration limits and annual release limits for SO_2 and NO_x . These are currently 4300 mg/m^3 and 1750 tonne/yr for SO_2 and 780 mg/m^3 and 320 tonne/yr for NO_x . Monthly reporting of the numbers are provided to HMIP based on calculations.

The IPC authorisation requires the direct measurements of the battery stack for SO_x , NO and NO_2 . In addition, every quarter the volume and mass of coke oven gas used for underfiring, mass of coal to the ovens, the sulphur content of the coal and the sulphur content of the coke oven gas have to be measured regularly, as required in Schedule 1.

5.5.4 By-Products Plant

The By-Products Plant produces a substantial number of emissions to air. Measurements of benzene and ammonia have been taken (using Drager tubes) around this area at locations 1m and 10m downwind of any likely emission source.

There are numerous vents on tanks and seal pots, gullies, pumps, pressure relief valves providing emission sources. Those of most concern from the results are in the CAL plant (NH_3 , 50 ppm) and the tar gully (organics, 10 ppm).

5.5.6 Gas Plant

Crude coke oven gas contains hydrogen sulphide, which is produced from sulphur in the coal. The hydrogen sulphide is removed from the gas exported along the pipeline by passing it through a series of boxes containing solid iron oxide ("bog ore"). After a period of time, the iron oxide becomes saturated and is removed from the boxes and disposed to landfill. The renewal of spent oxides from the gas purification plant takes place approximately 5 times/year, for 1 week each time. Spent oxide is discharged from the purifier box onto the ground and is then loaded, within the same day, into covered lorries for disposal offsite.

Since the renewal operation is periodic, it was not possible to determine the potential air emissions, during the unloading procedure. However, it would be expected that some "de-gassing" would occur as the oxide was dropped and moved around. This would be preferable to "de-gassing" on route to the landfill.

MCC are investigating the commercial feasibility of using a lower sulphur coal feed stock.

MCC stated that any leaks in the gas purification plant would be detected by pressure drops in the system or by smell. There is no automatic shutoff valve to the gas plant; a manual valve must be closed to route all gases to the flare, in the event of an incident in the gas plant.

5.5.7 Flare

Variations in production of gas and sales to customers through the pipeline, along with limited storage capacity necessitates a means of disposal of surplus gas at MCC. For this purpose a flare stack is installed which has recently been fitted with an automatic flow control/routing valve. Previously this was a manual valve, which allowed a limited amount of gas to be stored in the gas holder. The flare is a propane-spark ignition system, where combustion takes place at the flare tip and is 21.4m high.

NO_x , SO_x , CO and CO_2 are released in the combustion products. However, the volume of gas flared is not measured directly, but is the remaining balance after the subtraction of that which goes to the coke oven underfiring, purification plant and the boilers.

5.5.9 New Plant Standards

The Chief Inspectors Guidance notes for Carbonisation and associated processes, Coke manufacture (IPR 1/9) require that all plants are brought up to new plant standards by 1st April 1998. Atmospheric emission of SO₂, NO_x and particulates are currently in excess of new plant standards and action will have to be taken to reduce emissions. HMIP are particularly concerned about emissions of SO₂ from the plant. MCC are examining markets/methods to increase sales of purified gas which, in turn, will reduce the amount of gas to be flared and hence emissions of SO₂ from the flare. However, the release concentration from the coke oven battery for SO₂ is currently 4300 mg/m³. This will need to be reduced to 800 mg/m³ by 1/4/98. Reduction of SO₂ emissions to this level may be achieved by a combination of desulphurisation and the use of low sulphur coal. The cost of the Stretford desulphurisation is in excess of £3 million, with high operating costs. It may be possible to achieve significantly lower capital and operating cost of desulphurisation by combination with low sulphur coal. HMIP believe that NO_x and particulate emissions can be accommodated through good practice. It is recommended that the cost of meeting new plant emission standards is researched thoroughly as this may be a major capital cost within the next four years.

The costs discussed above will be offset against the costs of operating the gas purification plant, which would no longer be required.

5.6 Soil and Groundwater Assessment

5.6.1 Observations

The assessment of soil and ground contamination is discussed in relation to site observations and reference is made to the numbered observation points given on the plan of the site, figure 3.5 and the more detailed layout of the main processing area, figure 5.1. The area outside the by-product plant is described first.

Site Boundary

The Lineside Dyke and the area below the sandstone escarpment, next to the freight railway line was examined in detail. The Lineside Dyke flows South along the railway line. MCC have recently installed a 200mm slotted pipe (J to K, figure 3.5) inside the ditch to carry surface water and any leachate to the sump (L, figure 3.5) from where it is pumped to the BET plant. The pipe runs

It is recommended that the nature of contamination is investigated as part of a general investigation of the site.

The land beneath and around the gas holders at the gas purification plant and on the main site is likely to be contaminated with tars, polyaromatic hydrocarbons including benzene, anthracene, pyrans and phenols. These are potential contaminants of surface and groundwater. It is recommended that the nature and level of contamination should be examined as part of a contaminated site investigation.

Main Process Area

The following section describes observations of soil and ground contamination and references observation points on the plan of the main process area (figure 5.1).

If tankers are overfilled with by product the excess product is returned to the liquid/ tar decanter tanks. At this location there is evidence of spilt tar/ oil on the ground, which is not hard standing (V, figure 5.1). In fact most of the process area is not hard standing which allows any spills, leaks or accidental releases to penetrate the ground.

There is also evidence of tar spillage underneath the primary coolers probably originating from the seal pots (W, figure 5.1).

The six benzole plant steam pumps will not operate unless the glands are loosened. As a result there are leaks from seals around the flanges. The pumps have to be topped up regularly with oil. The pumps are not banded and, hence, there is gross contamination of the ground around these pumps (B, figure 5.1 and photograph, figure 5.10). Tar flows from the pump area into an open gully and then to the tar drains tank. The ground is contaminated with tar, oil and benzolised oil.

Until recently, the site contained two underground liquor tanks from the ammonia washers (X, figure 5.1). MCC have now removed these tanks and reported that the brickwork was in excellent condition. Clearly, if the brickwork was cracked this would have led to ground contamination.

There is evidence of spillage of lubricating or hydraulic oil under the building containing the export gas boosters (Y, figure 5.1). This is a hard standing area and some of the contamination is being carried away by run-off.

The ram road deposit underground sump is no longer used and is in the process of being decommissioned. The sump used to accept tar from three of the primary coolers via a tar gully. The primary coolers provide crude separation of tar and liquor and it is likely that the tar was contaminated with ammonia liquor and benzole. The ram road sump also accepted water separated from crude benzole in the Woolfe Coolers. It was not possible to examine the integrity of the sump but this is another potential source of ground contamination (Z, figure 5.1). The sump cannot be fully decommissioned until some other drains are diverted. This work is in hand. The ram road sump still had oily effluent flowing into it at the time of the site survey. The area around the ram road sump was heavily contaminated with oily tar (photograph, figure 5.13).

5.6.2 Data interpretation

No investigations of soil and groundwater contamination have been carried out by MCC or ICI.

The NRA have undertaken analyses of surface waters in the vicinity and these data are presented in Appendix II. The first set of data is an analysis of monthly samples taken from the discharge to the Lineside Dyke during 1992, prior to the discharge being redirected. The discharge to the Lineside Dyke is consented by NRA and limits set on particular parameters. The BOD limit was exceeded on four occasions and the free and fixed ammonia limit together were exceeded on three occasions. NRA use a guide level for monohydric phenols in surface water of $100\mu\text{g/l}$. The EC limit for phenols in drinking water, given in the Drinking Water Directive (80/778/EEC), is $0.5\mu\text{g/l}$ due to the ease with which it taints water. Phenols are non-toxic to fish at the 1mg/l level. The $100\mu\text{g/l}$ guide was exceeded on 4 occasions and is exceeded by 40 times on one occasion (i.e. $> 4\text{mg/l}$). As a reference, the YW consent limit for discharge of thiocyanates to sewer from the BET plant is set at 10mg/l . This limit was exceeded on two occasions for the Lineside Dyke discharge to surface water rather than sewer. These data give an indication of some of the pollution through discharge that reached the Lineside Dyke. However, it should be noted that the measuring point is upstream of the main point of discharge of leachate from the sandstone escarpment and therefore cannot be taken as a measure of the leachate contamination, which is likely to be of higher contaminant concentrations.

The second set of NRA data are monthly samples for 1992 and 1993 taken from three locations; Hemp dyke at Sandybridge, about 1Km ESE of the plant; Cudworth Dyke at Boulder Bridge, about 1.5Km S of the plant and on Sandybridge Dyke upstream of the plant. The measurements show that phenols are being picked up in

Contamination from the site is likely to have migrated through the soil into the underlying aquifer. As mentioned in section 3.2 abstraction is generally for mine water drainage and there are no licensed abstractions for potable water in the vicinity. The general quality of the water probably makes it unsuitable for potable supply. There may be unlicensed abstractions for use in allotments which would provide a pathway back to man. There are a number of old wells in the area and one, North of Royston, close to allotments, may still be used on these allotments. Further investigation is recommended to study potential pathways to man as part of a contaminated site investigation.

The level of groundwater in the sandstone aquifer is influenced by the mines drainage. As collieries in the area close, mine drainage will cease and the aquifer will refill, creating new springs and providing a link to surface water. This is a potential pathway to the environment which could cause harm to streams and aquatic life. This could also provide a pathway back to man through water supplies or the food chain. It is recommended that a programme of regular surface water sampling is undertaken which should include dykes to the south of the site, mine water and canal water.

The Winterset and Cold Hiendley Reservoirs to the North of the site are on a higher geological sequence than the Mexborough Sandstone and it is, therefore, very unlikely that contamination would reach these reservoirs.

The MCC site lies in the South Yorkshire coalfield and there are over 50 shafts in the Barnsley area alone. There are 3 disused shafts located within the site. The British Coal, Coal Mining Report states that ground movement from these past workings should by now have ceased. Also, British Coal have no records of a claim being made for subsidence at the MCC site. Clearly, because of the level of past mining activity in the area there is a risk of subsidence. However, based on the information available, the risk is thought to be low.

Past mining activity can provide a route for the rapid transport of contaminants in groundwater. Groundwater will seep into the coal mines from the sandstone. Mine water is pumped out for industrial use and may find its way into surface water as discussed above.

5.7 Safety Issues

5.7.1 Health and Safety Organisation

5.7.2 Control of Substances Hazardous to Health

The MCC have carried out a program of health risk assessments, under the requirements of the Control of Substances Hazardous to Health (COSHH) Regulations, 1988. These were conducted as a joint exercise, using internal resources (Mr. Simon Miller) and an external ICI specialist. The facility was divided into a number of areas and the ICI format was used for assessing the potential for a health risk to personnel due to exposure to the materials present in those areas.

Schedule 10 of COSHH lists those substances and processes which are classified as carcinogenic, for the purposes of the Regulations. Benzene, benzo-(a)-anthracene, benzo-(a)-pyrene, benzo-fluoranthene (b, j and k), which are constituents of coke oven gas, are all listed, as are coal tar fumes.

The assessments identified that there were several operations at the site which potentially exposed personnel to levels of hazardous materials greater than the allowable limits. Subsequently, personal protective equipment (PPE) was specified for work in these areas. The two main plant areas were the coke ovens and the concentrated ammonia locations.

One area which was not judged to require an assessment was that of the Benzole absorbing oil, currently supplied by Bitmac Ltd. This is surprising since the product data sheet identifies it as being composed primarily of naphthalene, alkyl naphthalenes and three-ring aromatic compounds. It is an irritant and can cause damage to internal organs at higher exposure levels. It is recommended that this area is assessed in future.

5.7.3 Cyclohexane Soluble Matter Assessments

Since the publication and introduction by the Health and Safety Executive (HSE) Factory Inspectorate of a document aimed at "Reducing Operator Exposure to Fumes and Smoke from Coke Ovens", regular monitoring has been carried out at MCC by BCRA, an external consultant. The original survey was completed in 1982, with further surveys being carried out in 1987, 1989, 1991, 1992 and 1993. Monitoring is formulated to establish operator exposure to both benzene (or cyclohexane) soluble material and dust.

The HSE notes are aimed at preventing occupational diseases associated with the inhalation of noxious materials contained in the benzene (or cyclohexane) soluble fraction of smoke and fume emissions from coke ovens by reducing the exposure of persons

noise and a difference of 10 dB or higher is obtained, then complaints are likely. One potential area of concern were the vehicle reversing alarm signals, which were very audible at the houses and would probably lead to night time complaints.

5.8 Emergency Planning and Response

There is no requirement for the MCC to have an onsite or offsite emergency response plan under the duties of the Control of Major Accident Hazards (CIMAH) Regulations, 1984. However, a response plan has been devised to cater for minor and more serious emergencies at the works.

The Site Emergency Plan was examined, which was in fact two documents containing different aspects of the procedures.

The emergency alarm responses are detailed and the evacuation procedures listed. An Emergency Control Centre and Incident Controller are designated in the procedures, as are several other key, trained personnel in operating areas. There are some responsibilities detailed for the Incident Controller and the Weighman in the event of an emergency. However, the plan would benefit from more detail on other individuals' roles and for all relevant information to be summarised in one document.

The emergency alarm is tested every Friday at 11:00 hrs for 20 seconds.

Other more specific emergency response plans were examined :

- Biological Treatment Plant
- Caustic Tank
- Tar Storage Tank
- Ammonia Product Storage Tank

These procedures identified the appropriate actions to be taken in the event of a range of possible emergency scenarios. It is recommended that the specific emergency plans are extended to cover other plant areas, such as the Benzole Storage Tanks, the gas plant and the boiler house.

5.9 Other Areas

5.9.1 PCBs

The transformers on site were changed and relocated in 1986. Tests for PCBs are carried out every two years by Yorkshire Electricity. No PCB contamination has been found.

The location of the transformers prior to 1986 is shown on figure 3.5 (location points AA and AB). These transformers would have

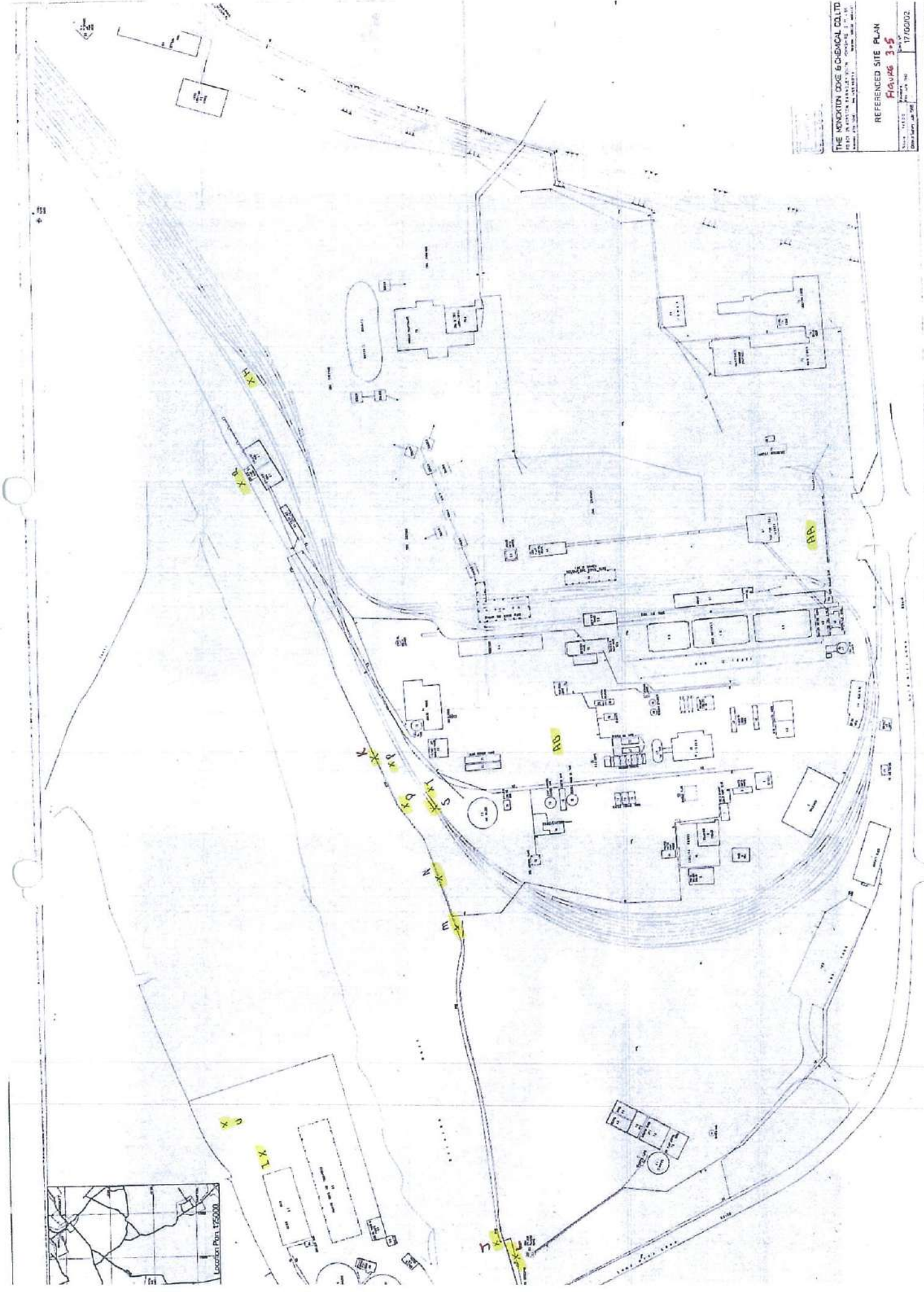
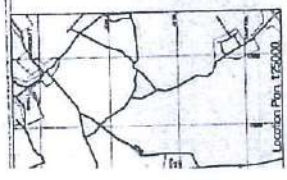
5.9.5 Complaints

During the period October 1989 to July 1993 nine complaints were received. The complaints came from three individuals and related to smoke, odour and noise. They were isolated, short term events and appear to have been dealt with quickly and in a satisfactory way.

5.9.6 Gas Pipeline Inspections

The Royston/Barnsley M.P. Main is checked twice a year under the terms of an inspection and maintenance, which is held between MCC and British Gas North Eastern. This is principally to verify that there is an adequate level of cathodic protection on the line, to prevent corrosion and the potential for a subsequent leakage. Copies of reports referencing work carried out in 1992 and 1993 were examined.

Figure 5.1 Plan of the main production area , showing observation points.



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Figure 5.9 Blue coloration at Gas Purification Plant



Figure 5.10 Benzole plant pumps showing ground contamination.



Figure 5.13 Contamination around the ram road sump.



Table 6.1 Projects completed under the planned improvement programme

Title	Description of completed improvement	Reference in application
Modification to CAL Plant	Installation of a horizontal 220 m ³ storage tank for off-specification concentrated ammonia liquor.	5.1.1
Additional liquor storage	Installation of a 220 m ³ liquor storage tank.	5.1.2
Redirection of condensate and liquor run-offs	Redirection of the flows to the concrete deposit sump, and D+O tanks. Sealpot flows have been redirected to the liquor storage tanks, excess flushing liquor has been redirected to the liquor store tanks, condensate from the primary coolers returns directly to the tar/liquor decanters. The concrete deposit sump and D and O deposit sump have been removed.	5.1.3
Liquor drains tank	Install new liquor drains tank.	5.1.4
Effluent cooler	Install a heat exchanger to cool the ammonia still effluent prior to discharge to BET plant.	5.1.5
Electric pumps	Install an electric benzole sales pump and an electric exhaustor sump pump.	5.1.6
Leachate collection	Leachate flows from the sandstone escarpment into the Lineside Dyke. Install a sump in the Lineside Dyke and pump from the sump into the BET plant. Blowdown waters redirected to the quench pond.	5.1.9
Flare stack automation	Fit an automatic valve in the feed to the flare stack to maintain a constant level in the gas holder.	5.1.10

Title	Description of completed improvement	Reference in application
Monitor NO _x and agree methods with HMIP	System of measurement of NO _x using a portable analyser has been agreed by HMIP.	MC5.11
Measure SO ₂ concentrations	Off-site monitoring is carried out. Stack emission monitoring is not carried out.	MC5.12
Alarms on effluent ponds	Install high level and ultimate high level alarms on the effluent ponds.	MC5.16
Monitor and quantify emissions from by-product plant tank and sump vents	Monitor benzene and ammonia emissions one metre downwind of by-product tank and sump vents.	MC5.17
Mercury free caustic soda	Most of work done to investigate Mercury free caustic soda. Two quotes have been received and a report will be prepared.	MC5.18

Title	Description of Planned Improvement	Reference in Authorisation/ Application	Estimated Cost (£K)
Benzene release from storage tanks.	Provide a proposal and implement a plan to minimise the release of benzene from the storage tank.	Mc5.04	50
Boundary monitoring.	Provide a proposal and implement an agreed programme of environmental monitoring to include measurement of benzene, ammonia, hydrogen sulphide, particulate matter and odour at the site boundary.	Mc5.05a	50-100 + annual running costs
Low sulphur coal	Prepare a report assessing the availability of low sulphur coal and the economic factors affecting its use in the process.	Mc5.06	10
Flow of coke oven gas to boilers	Install equipment to measure the flow of coke oven gas to the auxiliary boilers.	Mc5.08	20
Smoke from gas flaring from battery bleeders.	Provide equipment to minimise the release of smoke during the flaring of gas from the battery bleeders. Techniques shall be employed to minimise the use of these bleeders. Duration of use of these bleeders shall be recorded on each occasion.	Mc5.09a	20
Use of excess coke oven gas	Assess the practicality for use of excess coke oven gas and prepare a report.	Mc5.10	10
SO ₂ concentrations	Carry out measurement of SO ₂ concentrations. The sampling methods and analysis techniques shall be agreed with the Chief Inspector (currently, stack monitoring is not carried out).	Mc5.12	10

7. CONCLUSIONS AND RECOMMENDATIONS

This section summarises the main conclusions from the ESS, the nature of the issue (e.g. non-compliance, potential prosecution), the recommended action to be taken and a broad estimate of the costs to carry out the recommendation. These recommendations are in addition to the improvements already planned by MCC and costed in section 6.

It should be noted that there was insufficient time to obtain accurate cost estimates by quotation. The figures given in this section are broad estimates of the costs using contractors/consultants and should be treated as indications of the costs. It is recommended that more accurate estimates are obtained.

Area/Section	Conclusion	Type of Issue	Regulatory Body	Action	Estimated Cost (£K)
Surface run off and site drainage, section 5.4.	Surface run off and site drainage appears to find its way into the canal. This water is likely to be contaminated with hazardous substances.	Potential prosecution.	HMIP/NRA	Replan site drainage and run-off control. Construct hard standing for the by-products area, install interceptor tanks and holding tank to take main drainage.	200
Surface run off and site drainage, section 5.4.	Surface run off and site drainage appears to find its way into the canal. This water is likely to be contaminated with hazardous substances.	Potential prosecution.	HMIP/NRA	Analyse current surface run-off and drain discharge to canal.	5/year
Leachate at gas purification plant, section 5.4.	Red coloured leachate in surface water at the gas purification is a potential contaminant of BET and may exceed YW consent conditions.	Non compliance, general environmental improvement.	YW	Analyse contents of the sump at the gas purification plant.	5/year
Soil and groundwater contamination, section 5.6.	The site is heavily contaminated and leachate is emerging from the sandstone escarpment into the Lineside Dyke. The nature and level of contamination is unknown.	Potential prosecution.	NRA	Analyse leachate from sandstone escarpment and Lineside Dyke.	5/year
Soil and groundwater contamination, section 5.6.	Potential contamination on surrounding banks at the gas purification plant.	General site improvement.	HMIP	Analyse contaminated areas.	20
Soil and groundwater contamination, section 5.6.	Potential contamination around gas holders at the gas purification plant and main site.	Potential soil and groundwater pollution.	HMIP/NRA	Analyse potentially contaminated areas.	25
Gas main condensate sump. Section 5.6.1.	Contamination from and around the gas main condensate sump may be migrating off site.	Non-compliance.	HMIP/NRA	Examine integrity of sump and contaminated area around sump.	10

Area/Section	Conclusion	Type of Issue	Regulatory Body	Action	Estimated Cost (£K)
Emergency plans, section 5.8	Emergency plans should be extended	General safety	HSE	Extend emergency plans to cover benzole storage tanks, the gas plant and the boiler house.	2
Security, section 5.9.3.	Non-site personnel can gain access to the site on the Western boundary.	General site improvement.		Improve Western boundary fencing.	10-20
Environmental management, section 5.9.4.	MCC have had a lot of support on environmental issues from ICI C & P.	General environmental improvement.		Carry out a review of environmental management procedures and develop an environmental management system.	10-25