

THE MONKTON COKE AND CHEMICAL
COMPANY LTD

GAS PURIFICATION PLANT, ROYSTON

REPORT ON A SITE INVESTIGATION

Project No	R/7/0138		
Date	November, 1997		
	Name	Signature	Date
Originator	A Colabella	A Colabella	20.11.97
Reviewed by	R Aldridge	R. Aldridge.	20.11.97

Pro-Soil Surveys Limited
Elton Lodge
Newton Road
LEEDS
West Yorkshire LS7 4HE

Tel: 0113 237 4700
Fax: 0113 239 2089

TABLE OF CONTENTS

Page No

SUMMARY

1. INTRODUCTION

1

2. THE SITE

2

2.1 Location and description

2

2.2 Geology

3

3. METHOD OF INVESTIGATION

4

3.1 Fieldwork

4

3.2 Laboratory testing

5

4. RESULTS OF THE INVESTIGATION

7

4.1 Fieldwork

7

4.2 Laboratory testing

10

5. DISCUSSION

16

5.1 Soils

16

5.2 Groundwater contamination

18

6. LIMITATIONS

21

FIGURES

FIGURE 1	Trial pit locations
FIGURE 2	Borehole locations

TABLES

TABLE 1	Contamination test results - trial pits
TABLE 2	Contamination test results - boreholes
TABLE 3	Contamination test results on water samples
TABLE 4	Results of permeability tests

APPENDICES

APPENDIX A	Trial pit records
APPENDIX B	Borehole records
	Standard penetration tests
	Water monitoring well installation and sampling details
APPENDIX C	Certificates of analyses
APPENDIX D	ICRCL 59/83 (second edition) Tables 3 and 4

SUMMARY

An investigation has been carried out to supplement work undertaken by Monckton Coke and Chemical Company. Eight trial pits have been excavated and seven boreholes put down, with monitoring wells installed at the borehole locations. Soil and water samples have been recovered and chemical analyses carried out.

Materials to the north of the gas purification plant comprise made ground to a depth of between 2 and in excess of 5 metres and generally consist of burnt shale, ash and clay. Beneath the purification plant made ground is present to between 1 metre in the north to about 2 metres in the south and comprises a mixture of shales, ash and clay with some brick.

Groundwater monitoring possibly suggests that two groundwater tables exist; one superficially contained in the fill materials and present at depths of between 0.2 and 1.2 metres and the other at depth within the bedrock with its piezometric level some 1.5 metres below the perched water table.

Chemical analyses indicate variable contamination of the soils, essentially with arsenic and complex cyanides. However, the levels of contamination are such that the site can be reclaimed to restricted open space use with minimal remediation.

Chemical analyses of the groundwater suggests contamination with cyanide and phenols across the site with some elevated concentrations of arsenic, cadmium and chromium. Acidic conditions exist in the perched water in the north reducing in acidity to the south. At this stage, the effect of the groundwater contamination is not known but, due to relatively impermeable strata at shallow depth, it is likely only to affect the watercourses and shallow groundwater adjacent to and south of the site.

The need for remediation of the groundwater, if necessary, will be dependent upon further work and discussion with the Environment Agency.

1. INTRODUCTION

This investigation has been carried out at the request and to the direction of the Monckton Coke and Chemical Company (MCCC), Royston. The purpose of the investigation was to supplement a preliminary investigation carried out by MCCC which identified contamination associated with activities on the site, the objectives were to identify the depth of contamination within the subsoils and provide an initial assessment of possible groundwater contamination with a view to remediating the site in the future to open space use. To this end the investigation has involved the excavation of trial pits, the sinking of boreholes, installation of water monitoring wells, soil and water sampling and laboratory testing, all carried out to the direction and requirements of MCCC.

2. THE SITE

2.1 Location and description

The site, at NGR SE 373 119, is located east of Royston, immediately north of the B6428, some 6 kilometres north-east of Barnsley town centre. The area under consideration comprises the gas purification plant and land immediately to the north; the area of the purification plant is essentially flat and mainly covered with concrete hardstandings and roadways and contains an oxide shed, purifiers, various effluent, liquor and fuel oil tanks together with a cooling tower and gas holders.

The area occupied by the purification plant is some 0.4 hectare and about 120 metres long (north-south in orientation) and 50 metres at its widest.

North of the purification plant, levels rise sharply with the differences indicated to be about 8 metres with part of this higher ground formed by spoil materials; to the east a spoil embankment is present, estimated to a maximum of 14 metres at its highest point in the north. A beck, flowing in a southerly direction, runs along the western boundary at a level below general site levels.

The plant is used to purify gas which is generated as a byproduct from a coking plant to the north.

The general ground slopes in the locality are to the south-west towards a watercourse, running in a north-east to south-west direction, some 200 metres west of the site.

2.2 Geology

Published information, British Geological Survey Sheet 87, 1:50,000 series, solid and drift edition, indicates the site to be underlain by undifferentiated shales and mudstone beneath the horizon of the Mexborough Rock, a sandstone, present to the north-east and above the level of the site. A conjectured outcrop of a coal seam is indicated to pass through the site.

3. METHOD OF INVESTIGATION

The general proposal for the site, after decommissioning of the gas plant, is to regrade it by reducing levels to the north and raising levels in the south. Therefore, the proposals for the investigation were to excavate trial pits in the higher ground to the north (where up to 3 metres depth is to be removed) to establish the nature of the materials, whilst in the south (over the area occupied by the purification plant), where filling is to take place, the aim of the investigation was to identify the type and extent of residual contamination.

3.1 Fieldwork

Seven trial pits were excavated in the spoil materials north of the gas purification plant on 22 September, 1997. The trial pits were taken to a maximum overall depth of 5.8 metres using a wheeled backhoe excavator, the materials exposed were logged and a series of small disturbed samples were taken for laboratory testing.

Over the area of the gas purification plant, seven boreholes were put down, using light cable percussion techniques, to depths of between 5.0 and 6.0 metres, during the period 22 to 25 September, 1997. Disturbed samples were recovered, as boring progressed, from both the cutting shell and split spoon sampler; in addition occasional 100mm diameter open drive undisturbed samples were recovered from the underlying clay strata. The samples were used to aid the description of the materials encountered and to enable chemical analyses to be carried out. The split spoon sampler was cleaned between sampling operations with the general equipment cleaned between borehole moves.

On completion of the boring, a water monitoring/sampling well was installed within each borehole. These comprised 50mm diameter PVC tubing which was

perforated over a sealed response zone. The wells installed within boreholes 1 to 6 were to sample the perched water table encountered, whilst the well installed in borehole 7 was to sample a lower water table identified in bedrock in borehole 5. Details of the installations are attached within Appendix B.

About 14 days after installation of the wells they were sampled using a clean PTFE baler. The wells were initially purged and a sample of the purged water was recovered. After purging, the wells were allowed to re-establish and a further set of samples recovered, the samples were stored in appropriate containers containing fixing agents and despatched to the testing laboratory to arrive within 24 hours of sampling.

The positions of the trial pits and boreholes are given on the Trial Pit and Borehole Location Plan appended as Figures 1 and 2 respectively.

3.2 Laboratory testing

The testing regimen adopted was specified by the Monckton Coke and Chemical Company on the basis of analyses carried out on samples previously recovered by themselves. A representative number of soil samples was selected from both the trial pits and boreholes together with two sets of samples recovered from the water monitoring wells, one set was obtained prior to purging the wells with the second set obtained after recharge. The suite of analyses comprised determination of the following:-

- Arsenic
- Cadmium
- Chromium

- Cyanide
- Lead
- Mercury
- Selenium
- Phenols
- pH

the analyses were carried out by an independent NAMAS laboratory to nationally accepted standard methods.

In addition to the above chemical analyses, three permeability tests were carried out to assess the characteristics of the clays beneath the site.

4. RESULTS OF THE INVESTIGATION

4.1 Fieldwork

Detailed descriptions of the materials encountered in the trial pits are given in the trial pit and borehole records, attached as Appendices A and B respectively. Included within the records are details of the sampling and groundwater observations. The trial pit records also contain information regarding the stability of the excavations whilst the boreholes records include the results of the standard penetration tests. Details of the well installations are included on separate sheets. In view of the differing aims of trial pits and boreholes the materials exposed by each is considered separately and a summary of the ground conditions is given below.

4.1.1 Soil profile

Trial pits

Trial pits 1 to 4 inclusive and 5A were situated immediately north of the banking above the purification works and were to assess the materials likely to be removed. Trial pits 5, 6 and 7 were positioned further north to give an indication of the natural soil profile. Due to access difficulties it was not possible to examine the materials some 5 metres above the trial pit levels directly above the purification works.

Typically, above the purification works, the made ground horizons appear to comprise sand and gravel size burnt shale and proved to depths of in excess of 5 metres (approximate level of 50 metres) in trial pit 1 on the western side, whilst in trial pits 2 and 3 its depth was between 3.8 and 4.5 metres. In trial pit 2, the burnt

shale was underlain by ash and clinker to 5.1 metres over stiff clay; in trial pit 3, clayey silty fine sand was exposed between 3.8 and 4.2 metres over stiff clay. In trial pit 5A, deep blue surface staining was observed and similar staining is evident within the batter immediately above the purification works.

Trial pits 5, 6 and 7, positioned further north, proved a reduced thickness of fill varying between 0.9 and 1.85 metres in thickness. A superficial cover of burnt shale was present to about 0.5 metre depth beneath which sand and gravelly sandy silty clay fill was exposed. Underlying the made ground, stiff clay is present and grades to a weak mudstone with depth. In trial pit 7 a band of interbedded carbonaceous shale and coal was present between 2.4 and 2.8 metres depth.

Boreholes

Boreholes 1 to 4 inclusive were positioned towards the southern end of the site; typically these proved made ground, comprising a mixture of shale, ash, brick and some clay (principally borehole 3) to depths of between 1.85 and 2.65 metres; this was underlain by silty clay of variable consistency (soft to firm to stiff) to depths of between 3.0 and 3.5 metres where clayey mudstone was encountered grading into mudstone bedrock at a depth, generally below 4 metres.

Boreholes 5, 6 and 7 were located at the northern end of the purification plant. A reduced thickness of made ground was proved at between 0.65 metre depth in borehole 6 and 1.5 metres depth in borehole 5 and comprised a mixture of brick, clay and shale. In boreholes 6 and 7 firm and soft yellowish clays were present to respective depths of 1.4 and 1.6 metres; in borehole 5 the made ground below 0.85 metre consisted of soft clays with naturally occurring soft yellowish clay present from 1.5 to 2.0 metres. Below depths of about 2 metres, firm to stiff and stiff clays are present, grading to mudstone bedrock below depths of about 4 metres.

In boreholes 1 and 2 the fill materials were stained blue to depths of 2.0 and 1.35 metres respectively and in borehole 2 an acrid odour was noted between 2.3 and 3.0 metres. Blue staining and a slight acrid odour was observed in borehole 3 both in the made ground, to 2.65 metres depth and in natural strata to 3.05 metres. A slight acrid odour was evident in borehole 4 in the made ground to 2.0 metres and natural strata to 3.3 metres. In borehole 5, blue staining and a slight acrid odour were noted to a depth of 2 metres, penetrating natural strata by 500mm whilst in borehole 6 acrid odours were present to 1.4 metres depth, some 0.8 metre into natural soils.

4.1.2 Groundwater

Details of the groundwater observations during the fieldwork operations are given in the trial pit and borehole records with details of water levels within the monitoring wells given in the well sampling details, Appendix B.

During the boring operations seepages of water were generally observed between depths of 0.65 and 1.35 metres with deeper water strikes only observed in boreholes 5 and 6 at respective depths of 4.7 and 3.75 metres, these rising to 3.9 and 2.9 metres below ground level respectively.

The monitoring wells were generally installed to allow sampling of the water in the superficial soils. However, the well installed in borehole 7 allowed monitoring at a deeper level in bedrock.

Monitoring of the wells indicates depths to water in the superficial soils at between 0.2 metres in the north and 1.2 metres in the south; when these are related to relative borehole levels (see attached sampling summary sheet) these suggest a

hydraulic gradient to the south-west. The monitoring well installed in borehole 7 recorded water at a depth of 1.8 metres, this was some 1.7 metres below the water level in borehole 5 positioned nearby; this possibly suggests that the water table within the underlying bedrock to be isolated from the superficial water table.

During sampling of the wells it was observed that the water in boreholes 5 and 6 had a red colouration.

4.2 Laboratory testing

4.2.1 Chemical analyses

The results of the laboratory testing are presented as Tables 1, 2 and 3 with certificates of analyses attached in Appendix C. Table 1 gives the results of the tests carried out on the soil samples from the trial pits positioned in the spoil heap to the north, Table 2 the results of the analyses on the soil samples recovered from the boreholes and Table 3 those of the water samples recovered from the monitoring wells.

As discussed previously, it is proposed to de-commission the gas purification plant and revert the land to restricted open space. When redeveloping or restoring contaminated sites, guidance on the acceptable levels of contamination is generally taken from Department of Environment document Interdepartmental Committee on the Reclamation of Contaminated Land (ICRCL) Guidance Note 59/83, second edition; this gives tentative trigger concentrations of selected contaminants and these are given in Appendix D.

With respect to the levels of contaminants in groundwater, there are currently no nationally accepted standards for water quality, with accepted levels being assessed

on a site by site basis taking cognisance of the general water quality in the area, status of any aquifer, licenced abstractions and the potential for groundwater movement towards watercourses and aquifers. For the purposes of this investigation, in the absence of national standards and guidelines, the levels of the contaminants in the water samples are used for comparative purposes.

Trial pit samples

Considering the contaminant levels in the soil samples from the trial pits, the results of the tests carried out indicate that the ICRCL trigger concentrations for open space are only exceeded in occasional samples for arsenic, complex cyanide, selenium and pH.

The trigger concentration for arsenic (40mg/kg) was exceeded in 8 samples (out of 19) with only three samples (from trial pits 1 and 2) having values above 100mg/kg; however, it should be noted that no action (intervention/remediation) level is given. Elevated levels of complex cyanide were only measured in samples from trial pits 5A and 6 at respective concentrations of 380mg/kg and 500mg/kg this compares with a threshold trigger level of 250mg/kg; however, these values are well below the action level of 5,000mg/kg. Additionally, it should be borne in mind that all levels of free cyanide were below 1mg/kg. The concentration of selenium in a single sample from trial pit 6 was 19mg/kg compared with a threshold concentration of 6mg/kg; again no action level is given.

The threshold trigger value for pH is 5 with an action value 3, only samples from trial pits 6 and 7 had values below 5 and these were above 3 at respective values of 3.7 and 4.4.

Borehole samples

The purpose of carrying out analyses on the soil samples from the boreholes was to obtain an indication of the penetration of contaminants from site processes into the underlying soils. It was decided that this could be generally assessed from levels of cyanide, phenols and pH value. The levels of the other determinands would give an indication of general contamination by inorganic compounds.

Comparing the concentrations of phenol, it would appear that elevated levels of phenol are restricted to boreholes 1 to 4 inclusive. Typically, concentrations are below the ICRCL threshold of 5mg/kg, with the greatest concentrations measured in the southern part in borehole 1 at 4.5 and 5.25 metres depth, borehole 2 at a depth of between 0.5 and 1.45 metres, borehole 3 at 3.75 metres and in 3 samples from borehole 4 at 0.3, 1.75 and 4.45 metres. Concentrations of phenols in the soils in boreholes 5 and 6 are low with 5 of the 7 samples tested having levels of less than 1mg/kg, below the test detection limit, with the other values measured at 2mg/kg and 1mg/kg.

As discussed previously, the purpose of sampling within the boreholes was to assess the degree of penetration of contamination into the subsoils. With respect to the levels of cyanide, it would be accepted that for uncontaminated soil a level of less than 1mg/kg would be appropriate. The testing has indicated measurable quantities of cyanide to depth in all boreholes with levels generally being less than 50mg/kg which is well below the ICRCL threshold trigger level of 250mg/kg (action level 5,000mg/kg). The highest concentrations of cyanide have been measured in boreholes 1, 3, 4 and 5 at depths of less than 1.5 metres. In borehole 1, positioned east of the south-eastern corner of the purifiers, a concentration of 8,400mg/kg was measured at 0.5 metre depth with a level of 800mg/kg at 1.0 to 1.45 metres, in borehole 3 a concentration of 620mg/kg was obtained at 0.5 metre

depth with a value of 840mg/kg at the same depth in borehole 4. In borehole 5, concentrations of 800mg/kg and 1100mg/kg respectively were measured at depths of 0.5 and 1.0 metre. Excepting the sample from borehole 1 at 0.5 metre, all values were above the threshold trigger value but well below the action (intervention) level for development as open space; the sample at 0.5 metre in borehole 1 had a concentration of cyanide in excess of the action level. Generally, where the foregoing elevated cyanide concentrations were obtained, pH values typically in the range 3 to 5 were measured and, although below the threshold trigger value, were above the action level of 3.

With regard to the concentrations of the remaining determinands analysed, except for 5 samples (out of 25) which had slightly elevated arsenic levels (range 41mg/kg to 70mg/kg) all concentrations were below the open space threshold trigger value.

Water samples

As discussed above, there are no nationally agreed guidelines for the quality of groundwater. In the absence of these, general assessment levels would normally take cognisance of the quality of adjacent watercourses and groundwater in the environs and would be subject to discussion with the Environment Agency. The requirements for this investigation were specific in that sampling was to be restricted to within the site and that discussions with the Environment Agency were not required at this stage. Therefore, taking the foregoing into consideration, no assessment levels have been used for the water samples and the results obtained have been used comparatively.

Except for borehole 5, where an instant recharge of the monitoring well was experienced, samples were obtained after purging (A samples) with a sample of the purged water also recovered (B samples), all these were tested. From inspection of

the results for the purged water samples and those recovered after purging there appears little difference between the concentrations of the various determinands and the following observations are made.

For arsenic, a significant concentration (when comparing levels across the boreholes) is observed in the samples from boreholes 5 and 6 where concentrations of $190\mu\text{g/l}$ and $300\mu\text{g/l}$ were obtained compared with other values of less than $10\mu\text{g/l}$. Relatively elevated levels of cadmium were obtained in the samples from boreholes 5, 6 and 7 where concentrations of between $60\mu\text{g/l}$ and $220\mu\text{g/l}$ were measured and these compare with concentrations of less than $50\mu\text{g/l}$ elsewhere. Chromium levels were elevated in boreholes 5, 6 and 7 where values of between $1,300\mu\text{g/l}$ and $5,600\mu\text{g/l}$ were measured compared with less than $1,000\mu\text{g/l}$ in the other boreholes. The level of cyanide within all of the boreholes appears consistently elevated with concentrations in the range $5,000\mu\text{g/l}$ to $140,000\mu\text{g/l}$; with values typically in the range $10,000$ to $30,000\mu\text{g/l}$. Notably the higher levels were in the samples of purged water from borehole 2, where a concentration of $140,000\mu\text{g/l}$ was measured, this compares with a value of $28,000\mu\text{g/l}$ in the sample recovered after purging; and in boreholes 4 and 5, where concentrations of about $60,000\mu\text{g/l}$ were measured. The concentration of lead in the samples was generally less than $50\mu\text{g/l}$ with only borehole 5 having a slightly elevated concentration of $70\mu\text{g/l}$.

When analysing the samples for mercury, due to the coloration of the samples, the achievable detection limits were variable; on the samples from boreholes 1, 4 and 7 detection limits of better than $1\mu\text{g/l}$ were obtained, whilst for the samples from boreholes 2 and 5 a detection limit of $20\mu\text{g/l}$ was achieved. With the samples from boreholes 3 and 6 a detection limit of better than $1\mu\text{g/l}$ was obtained in the purged water sample whilst for the samples recovered after purging the achieved detection

limit was $20\mu\text{g/l}$. Where a low detection limit was achieved the maximum concentration of mercury was in borehole 7 and about $3\mu\text{g/l}$, in the remainder the level was less than $0.1\mu\text{g/l}$. In the samples where a $20\mu\text{g/l}$ detection limit was achieved this level was not exceeded; however, comparing the levels in the samples of purged water it is likely that the concentrations are below $0.1\mu\text{g/l}$.

For phenol, a detection limit of $50\mu\text{g/l}$ was achieved. In borehole 7, the concentration of phenol was below the detection limit, in the remaining boreholes the concentrations were typically $100\mu\text{g/l}$ to $200\mu\text{g/l}$ but with the purged water sample in borehole 2 having a concentration of $590\mu\text{g/l}$.

Selenium was only detected (detection limit $0.3\mu\text{g/l}$) in boreholes 2, 5 and 7 at levels between $0.7\mu\text{g/l}$ and $5\mu\text{g/l}$.

Except for boreholes 5 and 6, pH values of the water samples were in the range 4.7 to 7.2, in boreholes 5 and 6 the pH values of 2.1 and 2.5 measured are indicative of quite acidic conditions.

4.2.2 Geotechnical tests

The results of the permeability tests are presented as Table 4; the purpose of the tests was to ascertain the hydraulic conductivity of the clays beneath the site.

The results of the tests indicate permeabilities in the range 3×10^{-9} m/s to 3×10^{-11} m/s. In comparing these, a normally accepted value for a 1 metre thick landfill site liner would be 1×10^{-9} m/s which suggests the clays beneath the site to have a permeability similar to, or better than, the accepted standard.

5. DISCUSSION

As discussed earlier, it is proposed to decommission the gas purification plant at Royston and restore the area to restricted open space and this report was to supplement some limited work previously carried out by the Monckton Coke and Chemical Company. The proposals include regrading the site by moving materials from the higher ground in the north to south to cover the existing plant area. The investigation has been carried out to the direction of Monckton Coke and Chemical Company and to provide a preliminary assessment of the materials and groundwater, it has not been the intention to carry out a full environmental assessment of the site. Consequently, the comments made in this report relate to information obtained for the specific locations investigated.

5.1 Soils

In restoring the site the only nationally accepted guidelines for the reclamation of contaminated land is that given in ICRCL 59/83, second edition, and as such when considering remediation reference has been made to this. With regard to the disposal of materials off site, it is understood that no soils are to be removed from site, should this situation change the implications of doing so will need to be discussed with the appropriate waste disposal authorities, waste carriers and receivers. The decommissioning of the plant at the site together with the removal of tanks, and liquors therein, are, at this stage, considered to be outside the current brief but cognisance should be taken of these in the overall remediation of the site.

Firstly, considering the materials in the northern part of the site, with the exception of occasional elevated arsenic levels, primarily trial pits 1 and 2, the concentrations in the soils are below or marginally exceed the ICRCL threshold concentrations for open space; the levels measured in trial pits 1 and 2 are some 3 to 4 times the threshold level, however, no action (intervention) level is given. Excepting the

foregoing, the only other investigated contaminant above ICRCL 59/83 open space threshold levels was complex cyanide, this was up to three times the threshold value of 250mg/kg but less than the action level of 5000mg/kg. Taking the foregoing into consideration together with the proposed restricted access, the use of materials from the northern part of the site over the southern area should prove acceptable. Should there be general access to the area then some inert cover should be provided and it is likely that a 500mm thickness will suffice.

With regard to soils beneath the purification plant, the boreholes suggest levels of contaminants to be generally below the ICRCL open space threshold. This was only occasionally exceeded by arsenic with values up to 70mg/kg.

Occasionally, the level of complex cyanide was above the ICRCL threshold, and except for a sample at 0.5m from borehole 1, was below the action level. The sample from borehole 1 had a level of complex cyanide of 8410mg/kg nearly twice the action threshold. The levels of the other analysed determinands were close to or below the ICRCL open space trigger threshold.

With regard to the remediation of the site, for the proposed end use it is not considered necessary to remediate the site and the existing materials could remain in place; as previously mentioned, only if general access is available to the site will an inert cover to any contaminated materials be necessary.

With respect to the potential health risk associated with the identified contaminants within the soils, it is considered that the greatest risk is posed by arsenic and complex cyanide. To humans, arsenic can be highly toxic by ingestion, skin contact and dust inhalation, although the levels of arsenic measured are relatively low it would be advised that suitable protective clothing be worn and good personal hygiene be adopted by construction workers (who are likely to be at highest risk)

when handling the materials on the site. In dry and dusty conditions it may be advisable to wear dust masks.

Complex cyanides are relatively non-toxic and skin contact with significant quantities of spent oxide ($>50\text{g/kg}$) can cause skin irritation. Taking into account the levels measured in the soils, no significant risk will be posed to construction workers provided that the precautions detailed for arsenic are adhered to. Generally, the level of free cyanide measured across the site was less than 1mg/kg and, therefore, there is considered to be no significant health risk from free cyanide.

Having taking the foregoing into consideration, it should be borne in mind that there may be areas of the site which may have more contaminated areas and these include the areas of buried tanks and possibly the gas holders, and it is likely that during demolition further investigation will be necessary.

5.2 Groundwater contamination

The assessment of groundwater contamination within a site is dependent upon several factors including the presence of watercourses within and without the site, the position of aquifers and their sensitivity to pollution, hydraulic conductivity of the soils and rocks beneath the site, general groundwater flows and activities and water quality in the general environs. To carry out a comprehensive investigation and assessment of groundwater contamination would involve installing monitoring wells at varying depths and within different strata within the site and around the curtilage, an assessment of the water quality in the watercourses and underlying aquifers beyond the site curtilage and discussions with the Environment Agency. Dependent upon the foregoing, and whether any groundwater contamination attributable to the site has been identified in the past, there would be a need for setting target levels for contaminants and the requirement for remediation.

The investigation carried out cannot be considered as totally comprehensive but does suggest some contamination of the groundwater. Inspection of the results clearly indicate the presence of cyanide in the groundwater across the site, including within the well (borehole 7) sealed into the mudstone. Phenols are also present and these appear to be confined to the perched water, with none detected in samples from borehole 7, and concentrated to the southern end of the site. Chromium is present throughout and appears to be concentrated in the superficial water in boreholes 5 and 6 in the north. Similarly, cadmium was only detected in boreholes 5, 6, and 7 and again in the perched water. The level of mercury across the site is low with the highest concentration recorded in borehole 7 and suggests higher concentrations in the waters at depth. Selenium was only identified in four wells and concentrations were low. Of significance across the site is the groundwater acidity, in boreholes 5 and 6 in the north quite acidic conditions have been identified with conditions becoming less acidic to the south and possibly consistent with dilution by groundwater flow to the south.

Taking the foregoing into consideration there is some evidence of contamination of the groundwater due to operations on the site. However, the need for remediation is dependent mainly upon whether the contamination from the site is impacting significantly on the watercourses and groundwater in the locality and whether other sources of contamination are impacting upon the site. It is considered that the greatest impact from the site will be on shallow groundwater and watercourses adjacent and south of the site; the site appears to be underlain by a significant thickness (between at least 1 and 2 metres) of relatively impermeable clay which should prevent significant downward migration of contamination. It is likely that once operations have ceased upon the site the potential for recharge with contaminants will reduce and the quality of groundwater should improve.

However, this is much dependent upon whether contaminants are entering the site from other sources.

At this stage the requirement for remediation is unknown but would be subject to further investigation and discussions with the Environment Agency.

6. LIMITATIONS

- 6.1 The conclusions presented in this report are based in part on the data obtained from a limited number of soil samples from trial pits and boreholes. It should be noted that the nature and extent of any variations of the materials encountered in the investigatory holes and other parts of the site will not become evident unless further investigation and/or redevelopment of the site takes place. If, at the time of future works, there is an apparent variation in the materials and conditions at the site it may be necessary to re-evaluate the conclusions made in this report.
- 6.2 Observations of groundwater at the site made during the fieldwork were under conditions indicated in the report. However, it should be taken into consideration that fluctuations in the level of groundwater may occur due to variations in rainfall and other factors different from those prevailing at the time of the investigation.
- 6.3 The conclusions made in this report relating to contamination are based in part upon various types of chemical data and are contingent upon their validity. Variations in the types and concentrations of contaminants may occur due to various factors including fluctuations in the groundwater table, varying groundwater flow paths, past disposal practices and the passage of time. Should additional chemical data become available in the future, these should be reviewed and the conclusions made in this report modified accordingly.
- 6.4 Chemical analyses have been undertaken for specific analytes during the course of this investigation. It must be noted that additional contaminants not investigated during the course of this study may be present in the soil and groundwater at the site.

TABLE 3

CONTAMINATION TEST RESULTS ON WATER SAMPLES

ANALYTES	UNITS	BH1 A	BH1 B	BH2 A	BH2 B	BH3 A	BH3 B	BH4 A	BH4 B	BH5 A	BH6 A	BH6 B	BH7 A	BH7 B
Arsenic	µg/l	<0.8	<0.8	5.4	<0.8	7.6	4.7	<0.8	<0.8	300	190	6.6	2.5	1.4
Cadmium	µg/l	<50	<50	<50	<50	<50	<50	<50	<50	220	140	120	60	80
Chromium	µg/l	520	270	960	900	370	280	130	80	5600	3500	2800	1300	1500
Cyanide (Total)	µg/l	26000	19000	28000	140000	19000	17000	62000	67000	61000	8900	5400	20000	18000
Lead	µg/l	<50	<50	<50	<50	<50	<50	<50	<50	70	<50	<50	<50	<50
Mercury	µg/l	0.041	0.060	<20	<20	<20	<0.005	<0.005	0.036	<20	<20	0.042	3.9	3.2
Phenols (Total)	µg/l	230	120	100	590	<50	190	140	160	150	110	90	<50	<50
Selenium	µg/l	<0.3	<0.3	2.3	2.4	<0.3	<0.3	<0.3	<0.3	4.4	<0.3	<0.3	0.7	<0.3
pH	N/A	4.9	6.2	4.7	4.6	6.4	6.3	6.5	7.2	2.5	2.1	2.5	5.8	5.7

1. A - Water sampling after purging well.

2. B - Sample of purged water.

3. Some of the water samples have a higher detection limit than the others. Given the high colouration of the samples, this was the best achievable limit.

TABLE 2
CONTAMINATION TEST RESULTS

ANALYTES	UNITS	BH 1 0.5m	BH 1 1.0 - 1.45m	BH 1 2.0 - 2.45m	BH 1 3.75m	BH 1 4.5m	BH 1 5.25 - 5.90m	BH 2 0.5m	BH 2 1.0 - 1.45m	BH 2 2.5m	BH 2 3.75m	BH 3 0.5m	BH 3 1.0 - 1.45m	BH 3 2.75m
Arsenic	mg/kg	60	14	<3	<3	<3	<3	69	69	11	<3	<3	<3	<3
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.0	2.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	58	47	18	17	32	32	23	26	13	29	32	17	15
Cyanide (Complex)	mg/kg	8400	810	28	18	13	7	91	92	16	12	620	<1	3
Cyanide (Free)	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lead	mg/kg	550	26	14	14	44	21	83	96	20	20	23	15	13
Mercury	mg/kg	1.7	0.4	<0.2	<0.2	<0.2	<0.2	0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Phenols	mg/kg	2	1	2	1	3	4	5	5	2	3	3	<1	3
Selenium	mg/kg	<0.5	<0.5	<0.5	1.5	<0.5	1.0	1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
pH	N/A	3.1	5.2	3.9	5.9	5.4	6.5	5.9	5.9	4.7	5.6	5.5	6.8	5.5

Results expressed as dry weight

■ Above ICRCL 59/83, 2nd edition (1987) threshold level for open space.

Sheet 1 of 2

TABLE 2
CONTAMINATION TEST RESULTS

ANALYTES	UNITS	BH 3 3.75m	BH 4 0.5m	BH 4 1.75m	BH 4 3.0 - 3.45m	BH 4 4.0 - 4.45m	BH 5 0.5m	BH 5 1.0 - 1.45m	BH 5 2.75m	BH 5 3.75m	BH 6 0.5m	BH 6 1.5m	BH 6 2.0 - 2.45m
Arsenic	mg/kg	<3	41	10	<3	<3	57	58	<3	<3	21	<3	<3
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.5
Chromium	mg/kg	34	38	34	32	31	32	45	15	31	23	13	33
Cyanide (Complex)	mg/kg	6	840	98	<1	9	800	1100	63	2	11	41	3
Cyanide (Free)	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lead	mg/kg	26	200	53	25	35	64	39	11	25	120	9	26
Mercury	mg/kg	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Phenols	mg/kg	5	5	6	2	5	<1	<1	<1	1	2	<1	<1
Selenium	mg/kg	1.0	<0.5	<0.5	<0.5	<0.5	2.5	8.5	<0.5	<0.5	1.0	<0.5	<0.5
pH	N/A	7.1	4.7	9.3	6.8	6.5	4.6	4.1	3.9	5.8	4.3	3.5	4.1

Results expressed as dry weight

■ Above ICRCL 59/83, 2nd edition (1987) threshold level for open space.

Sheet 2 of 2

TABLE 1
CONTAMINATION TEST RESULTS

ANALYTES	UNITS	TP 1 1.5m	TP 1 3.7m	TP 2 1.2m	TP 2 3.0m	TP 2 5.6m	TP 3 0.5m	TP 3 3.0m	TP 3 4.3m	TP 4 1.0m
Arsenic	mg/kg	130	160	180	20	3	41	44	<3	75
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	28	51	47	18	35	45	28	32	34
Cyanide (Complex)	mg/kg	20	10	26	3	1	17	81	<1	200
Cyanide (free)	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lead	mg/kg	43	45	85	35	27	59	21	33	39
Mercury	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2
Selenium	mg/kg	<0.5	<0.5	<0.5	1.0	<0.5	<0.5	<0.5	<0.5	0.5
Phenols	mg/kg	<1	<1	<1	1	<1	<1	<1	<1	<1
pH	N/A	5.9	6.5	6.6	4.4	6.3	6.4	6.3	7.5	5.5

Results expressed as dry weight

■ Above ICRL 59/83, 2nd edition (1987) threshold value for open space.

Sheet 1 of 2

TABLE 1
CONTAMINATION TEST RESULTS

ANALYTES	UNITS	TP 5 0.3m	TP 5 0.95m	TP 5 2.0m	TP 5A 0.2 - 1.8m	TP 6 0.4m	TP 6 1.1m	TP 7 0.3m	TP 7 0.8m	TP 7 1.1m
Arsenic	mg/kg	42	7	19	86	35	<3	14	3	<3
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	25	18	36	9	22	17	17	10	34
Cyanide (Complex)	mg/kg	17	1	<1	380	500	6	10	<1	<1
Cyanide (free)	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lead	mg/kg	51	29	47	62	26	15	26	7	23
Mercury	mg/kg	<0.2	<0.2	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2
Selenium	mg/kg	4.0	1.0	<0.5	5.5	19.0	<0.5	2.5	<0.5	<0.5
Phenols	mg/kg	<1	1	2	3	<1	2	<1	<1	2
pH	N/A	5.7	6.2	6.1	5.0	3.7	5.4	4.4	5.9	6.4

Results expressed as dry weight

■ Above ICRCL 59/83, 2nd edition (1987) threshold value for open space.

Sheet 2 of 2

FIGURES

FIGURE 1
FIGURE 2

Trial pit locations
Borehole locations

TABLES

TABLE 1	Contamination test results - trial pits
TABLE 2	Contamination test results - boreholes
TABLE 3	Contamination test results on water samples
TABLE 4	Results of permeability tests

TABLE 4
RESULTS OF PERMEABILITY TESTS

Borehole No	Sample Depth (m)	Moisture Content (%)	Dry Density (mg/m ³)	Coefficient of Permeability (m/s)
1	4.0 - 4.45	29	1.78	3×10^{-11}
2	2.0 - 2.45	20	1.70	3×10^{-9}
6	1.0 - 1.45	23	1.72	6×10^{-11}

Tests carried out to K.H. Head, Manual of Soils Laboratory Testing, Volume 3, Clause 20.4.2, Page 1020.

APPENDICES

APPENDIX A
APPENDIX B

Trial pit records
Borehole records
Standard penetration tests
Water monitoring well installation and sampling details
ICRCL 59/83 (second edition) Tables 3 and 4

APPENDIX D

APPENDIX A

Trial pit records

SHEET 1 OF 1

Method		Size	
WHEELED HYDRAULIC BACKHOE EXCAVATOR JCB 3CX		600mm Bucket	
Sample/Test			
Depth (m)	T Y P E		
0.30	D		
1.50	D	MADE GROM size sub: clinker l occasions	
3.70	D	MADE GROM burnt shi blocks, l occasions	
4.90	D	MADE GROM and cobb small bo	
22.09.97			

Remarks

Profile described from top of exposure, 2.5 metres above
Continuous collapse in base of excavation, no fur

Client/Contractor

THE HONCKTON COKE AND CHEMICAL CO. LTD

IT

2

FICATION PLANT,

000000-000000

nd Level 0.00 m(00)

Depth (m)	Level m (00)	Legend
0.30	-0.30	
3.00	-3.00	
4.50	-4.50	

Scale 1:25
Report 7/0138

Keys

Method		Size		Location		
WHEELED HYDRAULIC BACKHOE EXCAVATOR JCB 3CX		600mm Bucket		GAS PURIFICATION PLANT, ROYSTON 000000-000000		
Sample/Test				Ground Level		0.00 m(00)
Depth (m)	T Y P E			Description of Strata	Depth (m)	Level m (00)
0.50	D			MADE GROUND, topsoil and occasional brick rubble, frequent tree roots.	0.30	-0.30
1.20	D			MADE GROUND, predominantly orange/red sand to small cobble size burnt shale. Occasional deep red bands, occasional brick rubble, occasional coal fragments.	3.00	-3.00
				MADE GROUND, sand to gravel size burnt shale and brick rubble, occasional clinker gravel.	4.50	-4.50
4.70	D			MADE GROUND, wet black ash with traces of coal.		
5.00	D					

Remarks

Profile described from top of exposure, 3.0 metres above toe of batter.
Excavation dry, stable in natural ground.

Client/Contractor

THE MONCKTON COKE AND CHEMICAL CO. LTD

Pro-Soil Surveys

Scale 1:25

Report 7/0138

Method WHEELED HYDRAULIC BACKHOE EXCAVATOR JCB 3CX		Size 600mm Bucket		Location GAS PURIFICATION PLANT, ROYSTON 000000-000000		
Sample/Test		Ground Level		0.00 m(00)		
Depth (m)	T Y P E	Description of Strata		Depth (m)	Level m (00)	Legend
		MADE GROUND, wet black ash with traces of coal.		5.10	-5.10	
5.60	0	Stiff grey mottled brown slightly sandy silty CLAY (completely weathered MUONSTONE).		5.80	-5.80	
22.09.97						
Remarks						
Client/Contractor THE HONCKTON COKE AND CHEMICAL CO. LTD				Pro-Soil Surveys		Scale 1:25 Report 7/0138

RECORD OF TRIAL PIT

4

Method WHEELED HYDRAULIC BACKHOE EXCAVATOR JCB 3CX	Size 600mm Bucket	Location GAS PURIFICATION PLANT, ROYSTON	000000-000000
--	----------------------	--	---------------

Sample/Test		Ground Level		0.00 m(00)	
Depth (m)	T Y P E	Description of Strata		Depth (m)	Level m (00)
1.00	0	MADE GROUND, sand to gravel size burnt shale.			
				2.00	-2.00

Notes
Soil described from top of exposure, 1 metre above toe of batter.
Exposure dry.

Contractor

BLACKTON COKE AND CHEMICAL CO. LTD

Pro-Soil Surveys

Scale 1:25

Report 7/0138

RECORD OF TRIAL PIT

5

Method WHEELED HYDRAULIC BACKHOE EXCAVATOR JCB 3CX		Size 600mm Bucket		Location GAS PURIFICATION PLANT, ROYSTON			000000-000000	
Sample/Test				Ground Level		0.00 m(00)		
Depth (m)	T Y P E			Description of Strata	Depth (m)	Level m (00)	Legend	
0.30	D			MADE GROUND, topsoil on sand to gravel size burnt shale.			X	
					0.50	-0.50		
0.95	D			MADE GROUND, grey clayey shale.				
				MADE GROUND, black coally silt.	0.90	-0.90	X	
					1.00	-1.00		
2.00	D			MADE GROUND, brown sandy silty clay with some sandstone gravel, occasional sandstone boulder.			X	
					1.85	-1.85		
				Stiff buff mottled pale grey silty CLAY (completely weathered MUDSTONE).			X	
					2.30	-2.30		
		22.09.97						
Remarks Excavation dry and stable.								
Client/Contractor THE MONCKTON COKE AND CHEMICAL CO. LTD				Pro-Soil Surveys		Scale 1:25		
						Report 7/0138		

Method WHEELED HYDRAULIC BACKHOE EXCAVATOR JCB 3CX		Size 600mm Bucket		Location GAS PURIFICATION PLANT, ROYSTON			000000-000000	
Sample/Test				Ground Level		0.00 m(OD)		
Depth (m)	T Y P E			Description of Strata	Depth (m)	Level m (OD)	Legend	
0.20-1.80	D			MADE GROUND, sand to gravel size burnt shale, surface stained deep blue.				
		22.09.97			2.00	-2.00		
Remarks								
Previously excavated trial pit. Profile described from top of exposure, approx. 1 metre above toe of batter. Sample of blue surface staining taken.								
Client/Contractor				Pro-Soil Surveys		Scale 1:25		
THE HONCKTON COKE AND CHEMICAL CO. LTD						Report 7/0138		

Method WHEELED HYDRAULIC BACKHOE EXCAVATOR JCB 3CX		Size 600mm Bucket		Location GAS PURIFICATION PLANT, ROYSTON			000000-000000
Sample/Test				Ground Level		0.00 n(00)	
Depth (m)	T Y P E			Description of Strata	Depth (m)	Level m (00)	Legend
0.40	D			MADE GROUND, topsoil on sand to gravel size burnt shale.	0.35	-0.35	
				MADE GROUND, coaly silt.	0.50	-0.50	
1.10	D			MADE GROUND, grey, brown and red sandy silty clay with occasional sandstone gravel.	0.90	-0.90	
				Stiff mottled pale grey and brown silty CLAY (completely weathered MUDSTONE).	1.30	-1.30	
		22.09.97					
Remarks Excavation dry and stable.							
Client/Contractor THE MONCKTON COKE AND CHEMICAL CO. LTD				Pro-Soil Surveys		Scale 1:25 Report 7/0138	

Method WHEELED HYDRAULIC BACKHOE EXCAVATOR JCB 3CX		Size 600mm Bucket		Location GAS PURIFICATION PLANT, ROYSTON 000000-000000	
Sample/Test		Ground Level		0.00 m(OD)	
Depth (m)	T Y P E	Description of Strata		Depth (m)	Level m (OD)
0.30	D	MADE GROUND, topsoil on sand to cobble size subangular and angular burnt shale. Occasional subangular sandstone boulder.		0.60	-0.60
0.80	D	MADE GROUND, grey silty sand.		1.05	-1.05
1.10	D	Stiff mottled pale grey and brown silty CLAY.		1.70	-1.70
		Grey and brown thinly laminated highly to moderately weathered very weak MUDSTONE.		2.40	-2.40
		Interbedded carbonaceous SHALE and thinly laminated COAL.		2.80	-2.80
		Pale grey and brown thinly laminated moderately weathered weak shaly MUDSTONE.		3.00	-3.00
22.09.97					
Remarks Excavation dry and stable.					
Client/Contractor THE HONCKTON COKE AND CHEMICAL CO. LTD				Pro-Soil Surveys	
				Scale 1:25	
				Report 7/0138	

APPENDIX B

Borehole records
Standard penetration tests
Water monitoring well installation and sampling details

SHEET 1 OF 1

RECORD OF BOREHOLE

1

Type and Diameter of Boring

CABLE PERCUSSION BORING

150mm diameter. Cased to 3.15m.

Location

GAS PURIFICATION PLANT,
ROYSTON

000000-000000

Sample/Test		Drilling and Casing Progress	Water Level	'N' Value Core Rec. and (RQD)%	Description of Strata	Ground Level		Legend
Depth (m)	T Y P E					Depth (m)	Level m (OO)	
0.50	D				MADE GROUND: Loose fine, medium and coarse gravel of red burnt shale, brick, and black ash. Recovered as a slurry below 1.25m. Blue staining evident.			
1.00-1.45	DS			5				
1.75	D				Firm mottled grey, yellow, light brown silty, sandy CLAY.	2.00	-2.00	
2.00-2.45	DS			10				
2.75	D				Firm to stiff light brown very sandy, silty CLAY with coarse gravel of sandstone.	2.55	-2.55	
3.00-3.45	DS			25				
3.75	D				Stiff mottled dark grey, brown, yellow, red clayey MUDSTONE with sandstone and shale partings.	3.00	-3.00	
4.00-4.45	U					3.40	-3.40	
4.50	D				Stiff predominantly grey with black, yellow and brown clayey MUDSTONE with shale partings.			
4.75	D					4.30	-4.30	
5.00-5.23	DS			>100	Red and purplish-red stained grey MUDSTONE with shale partings, staining reducing with depth.			
5.25-5.30	DS	22.09.97		>100		5.30	-5.30	

Remarks

Seepage at 1.25m.

Chiselling from 5.00 - 5.30m, 45 minutes.

Refer to installation sheet for details of ground-water monitoring well.

Client/Contractor

MONCKTON COKE AND CHEMICAL COMPANY LTD

Pro-Soil Surveys

Scale 1:50

Report 7/0138

Type and Diameter of Boring				Location					
CABLE PERCUSSION BORING				GAS PURIFICATION PLANT,					
150mm diameter. Cased to 3.2m.				ROYSTON					
				000000-000000					
Sample/Test		Drilling and Casing Progress	Water Level	N _v Value Core Rec. and (RQD)%	Ground Level	0.00 m(00)			
Depth (m)	T Y P E					Depth (m)	Level m (00)	Legend	
0.50	D			15	MADE GROUND: Concrete.	0.20	-0.20		
1.00-1.45	DS				MADE GROUND: Loose to medium dense purplish red and red fine, medium and coarse gravel of brick, red burnt shale, black ash and blue staining evident.				
1.75	D				MADE GROUND: Soft brown silty sandy CLAY with fine to coarse gravel of brick, burnt shale.	1.35	-1.35		
2.00-2.45	U				Soft orange-brown silty sandy CLAY.	1.85	-1.85		
2.50	D			16	Soft brown very sandy silty CLAY with medium to coarse gravel of sandstone.	2.05	-2.05		
3.00-3.45	DS				Soft to firm light orange brown sandy silty CLAY with medium to coarse gravel of sandstone, slightly acid odour.	2.30	-2.30		
3.75	D				31	Stiff brown, grey thinly laminated weathered clayey MUDSTONE, ironstained on bedding.	4.60		-4.60
4.00-4.45	DS								
4.75	D								
5.00-5.45	DS			>100	Grey slightly clayey silty MUDSTONE.	5.40	-5.40		
5.75	D			>100	Grey thinly laminated MUDSTONE with coal and shale partings.	6.00	-6.00		
5.80-6.00	DS	23.09.97							
Remarks									
Concrete cased to 200mm depth, 250mm diameter. Refer to installation sheet for details of ground-water monitoring well.									
Seepage at 1.35m.									
Chiselling from 5.80m to 6.00m, 30 mins.									
Client/Contractor					Pro-Soil Surveys		Scale 1:50		
MONCKTON COKE AND CHEMICAL COMPANY LTD							Report 7/0138		

Type and Diameter of Boring

CABLE PERCUSSION BORING

150mm diameter. Cased to 3.2m.

Location

GAS PURIFICATION PLANT,

ROYSTON

000000-000000

Sample/Test		Drilling and Casing Progress	Water Level	RMR Value Core Rec. and (RQD)%	Description of Strata	Ground Level		
Depth (m)	TYPE					Depth (m)	Level m (OD)	Legend
0.50	D				MADE GROUND: Concrete.			
1.00-1.45	DS			5	MADE GROUND: Loose fine to coarse red and purplish red gravel of brick, burnt shale, grey shale and ash, blue staining evident. Slight acid odour.	0.20	-0.20	
1.75	D							
2.00-2.45	DS			7	MADE GROUND: Soft black/blue CLAY with traces of spent oxide. Slight acid odour.	0.80	-0.80	
2.75	D							
3.00-3.45	DS			15	Firm orange, grey, brown, black sandy silty CLAY with fine to coarse gravel of sandstone, stained blue in parts.	2.65	-2.65	
3.75	D							
4.00-4.45	DS			24	Stiff light grey silty CLAY.	3.05	-3.05	
4.75	D							
5.00-5.45	DS			>100	Light grey slightly weathered MUDSTONE.	4.05	-4.05	
5.75	D							
5.80-5.85	DS	23.09.97		>100				
						6.00	-6.00	

Remarks

Concrete cored to 200mm, 250mm diameter.
Seepage at 1.35m.
Chiselling from 5.80m to 6.00m, 30 mins.

Refer to installation sheet for details of ground-water monitoring well.

Client/Contractor

MORCKTON COKE AND CHEMICAL COMPANY LTD

Pro-Soil Surveys

Scale 1:50

Report 7/0138

Type and Diameter of Boring				Location				
CABLE PERCUSSION BORING				GAS PURIFICATION PLANT,				
150mm diameter. Cased to 3.2m.				ROYSTON				
				000000-000000				
Sample/Test		Drilling and Casing Progress	Water Level	'N' Value Core Rec. and (RCD)%	Description of Strata	Ground Level		Legend
Depth (m)	T Y P E					Depth (m)	Level m (OD)	
0.50	D			7	MADE GROUND: Brick and rubble fill on soft, dark grey, purplish grey, black, orange, clayey brick and ash with fine to medium gravel of burnt shale. Pushing obstruction to 2.0m. Slight acid odour.			
1.00-1.45	DS							
1.75	D							
2.00-2.45	DS			13	Firm yellow, orange, green, brown slightly sandy silty CLAY with coarse sand to medium gravel of sandstone, slight acid odour.	2.00	-2.00	
2.75	D			19	Firm to stiff orange, yellow, grey, brown sandy silty CLAY. Slight acid odour.			
3.00-3.45	DS							
3.75	D			42	Grey thinly laminated slightly weathered MUDSTONE. At 4.2m, thin coal partings.			
4.00-4.45	DS							
4.75	D							
5.00-5.45	DS			85				
5.75	D			>100				
5.80-5.95	DS	25.09.97						
Remarks								
Seepage at 1.10m.								
Chiselling from 5.70m to 6.00m, 30 mins.								
Refer to installation sheet for details of ground water monitoring well.								
Client/Contractor						Scale 1:50		
MONCKTON ECKE AND CHEMICAL COMPANY LTD						Pro-Soil Surveys		
						Report 7/0138		

Type and Diameter of Boring				Location			
CABLE PERCUSSION BORING				GAS PURIFICATION PLANT,			
150mm diameter. Cased to 5.0m.				ROYSTON			
				Ground Level		0.00 m(00)	
Sample/Test	Drilling and Casing Progress	Water Level	'N' Value Core Rec. and (RCD)%	Description of Strata	Depth (m)	Level m (00)	Legend
0.50	D			MADE GROUND: Concrete.	0.20	-0.20	
1.00-1.45	DS		3	MADE GROUND: Red and purplish-red brick and rubble fill, slightly acrid odour.	0.85	-0.85	
1.75	D			Soft yellow, green, purplish brown, grey sandy silty CLAY with coarse sand to medium gravel of brick and burnt shale, slightly acrid odour.	1.50	-1.50	
2.00-2.45	DS		1	Soft yellow, green, blue-black, grey sandy silty CLAY, blue staining evident, slightly acrid odour.	2.00	-2.00	
2.75	D			Firm to stiff grey and brown sandy silty CLAY.			
3.00-3.45	DS		16		3.20	-3.20	
3.75	D						
4.00-4.45	DS		37				
4.75	D			Grey and brown slightly weathered MUDSTONE.			
5.00-5.45	DS		89				
5.70	D						
5.80-6.02	DS	24.09.97	>100		6.02	-6.02	
Remarks							
Concrete cored to 200mm, 250mm diameter.				Water strike at 4.7m, casing at 3.2m, rising to 3.86m in 20 minutes.			
Seepages at 1.20m and 2.35m.				See sheet for details of groundwater well.			
Chiselling from 5.75m to 6.02m, 30 minutes.							
Client/Contractor				Pro-Soil Surveys		Scale 1:50	
MONCKTON COKE AND CHEMICAL COMPANY LTD						Report 7/0138	

Type and Diameter of Boring CABLE PERCUSSION BORING 150mm diameter. Cased to 3.9m.				Location GAS PURIFICATION PLANT, ROYSTON 000000-000000				
Sample/Test		Drilling and Casing Progress	Water Level	RM Value Core Rec. and (RQD)%	Ground Level	0.00 m(00)		
Depth (m)	TYP E					Depth (m)	Level m (00)	Legend
0.50	D				MADE GROUND: Concrete.	0.20	-0.20	X
1.00-1.45	U				MADE GROUND: Soft grey, blue, red, purplish-red, sandy, silty CLAY with fine to coarse gravel of burnt shale, brick.	0.65	-0.65	
1.50	D				Firm grey, yellow, brown, slightly sandy, silty CLAY, slight acrid odour.	1.40	-1.40	X
1.75	D				Firm to stiff grey, green-brown silty CLAY with fine gravel to cobble size fragments of weathered very thinly bedded sandstone and mudstone.	1.85	-1.85	X
2.00-2.45	DS			16				
2.75	D				Stiff dark grey/brown clayey weathered MUDSTONE.	3.75	-3.75	
3.00-3.45	DS			23				
3.75	D							
4.00-4.45	DS			41	Dark grey/black thinly laminated slightly weathered MUDSTONE.			
4.75	D							
4.90-5.05	DS	24.09.97		>100		5.05	-5.05	
Remarks								
Concrete cored to 200mm, 250mm diameter. Seepage at 0.65m. Chiselling from 4.70m to 5.05m, 30 minutes.					See sheet for details of groundwater well. Water strike at 3.75m, casing at 3.2m, rising to 2.91m in 20 minutes.			
Client/Contractor MONCKTON COKE AND CHEMICAL COMPANY LTD					Pro-Soil Surveys		Scale 1:50	
							Report 7/0138	

Type and Diameter of Boring

CABLE PERCUSSION BORING

150mm diameter. Cased to 3.2m.

Location

GAS PURIFICATION PLANT,
ROYSTON

000000-000000

Sample/Test

Drilling
and
Casing
ProgressWater
LevelRMR
Value
Core
Rec.
and
(RQD)%

Ground Level

0.00 m(00)

Depth (m)

TYPE

Description of Strata

Depth
(m)Level
m (00)

Legend

MADE GROUND: Soft orange, purplish-brown
sandy, clayey fill and brick and burnt
shale.

0.95

-0.95

Soft yellow, green, purplish-brown, grey
sandy silty CLAY with brick rubble.

1.60

-1.60

Soft yellow, green silty sandy CLAY.

3.00

-3.00

Firm to stiff mottled brown, grey silty
CLAY.

3.30

-3.30

Grey/brown moderately to slightly weathered
MUDSTONE.

6.00

-6.00

25.09.97

Remarks

Seepages at 1.15m and 2.15m.

Chiselling from 5.70 - 6.00m, 30 mins.

Refer to installation sheet for details of ground- water monitoring well.

Client/Contractor

HOWKTON COKE AND CHEMICAL COMPANY LTD

Pro-Soil Surveys

Scale 1:50

Report 7/0138

SUMMARY SHEET

STANDARD PENETRATION TESTS

BH	Test depth (m)	Test interval (mm) Incremental blow count						N value
		0-75	75-150	150-225	225-300	300-375	375-450	
1	1.0 - 1.45	5	5	4	1	0	0	5
	2.0 - 2.45	1	1	2	2	3	3	10
	3.0 - 3.45	2	4	5	6	6	8	25
	4.0 - 4.45							(150)
	5.0 - 5.23	21	35	50	-	-	-	>100
	5.25 - 5.30	50(50mm)		-	-	-	-	>100
2	1.0 - 1.45	3	4	5	5	3	2	15
	2.0 - 2.45							(150)
	3.0 - 3.45	2	3	4	4	4	4	16
	4.0 - 4.45	3	4	4	6	8	13	31
	5.0 - 5.45	13	20	22	27	29	35	113
	5.8 - 5.80	21	34	50(50mm)		-	-	>100
3	1.0 - 1.45	1	0	0	1	2	2	5
	2.0 - 2.45	1	0	1	2	2	2	7
	3.0 - 3.45	2	3	3	4	4	4	15
	4.0 - 4.45	2	3	5	5	6	8	24
	5.0 - 5.45	6	15	18	23	35	50	126
	5.8 - 5.85	50(50mm)		-	-	-	-	>100
4	1.0 - 1.45	1	2	2	1	2	2	7
	2.0 - 2.45	1	2	2	3	4	4	13
	3.0 - 3.45	3	3	4	4	5	6	19
	4.0 - 4.45	5	9	9	10	11	12	42
	5.0 - 5.45	11	13	16	20	22	27	85
	5.8 - 5.95	36	50	-	-	-	-	>100

() U100 blow count

WATER MONITORING WELL INSTALLATION AND SAMPLING DETAILS

Borehole No	Relative level (m)	Well response zone (m)	Date of Sampling	Initial water level (m)	Purged volume (litres)	Water level after purging (m)	Water level prior to sampling (m)
1	10.413	1.0 - 4.3	08.10.97	9.333	20	6.813	7.513
2	10.304	1.0 - 4.6	08.10.97	9.104	25	6.204	8.304
3	10.207	1.0 - 4.0	08.10.97	8.917	35	6.727	8.907
4	10.000	1.0 - 3.3	08.10.97	8.995	20	7.480	8.850
5	10.167	1.0 - 3.0	08.10.97	9.377	30	9.377	Instant recharge
6	10.443	1.0 - 4.0	08.10.97	10.253	20	8.243	9.143
7	10.165	3.3 - 6.0	14.10.97	8.365	20	4.665	7.965
Water levels							
1	10.413		14.10.97	9.363			
2	10.304		14.10.97	9.104			
3	10.207		14.10.97	8.987			
4	10.000		14.10.97	8.890			
5	10.167		14.10.97	9.567			
6	10.443		14.10.97	10.243			
7	10.165		14.10.97	8.365			

APPENDIX C Certificates of analyses

CERTIFICATE OF ANALYSIS

Client PRO-SOIL SURVEYS LTD.

Contract PROSOIL-0413

97043 ROYSTON/70138

Sample I.D No.	Sample Description	pH	Cyanide (Total)	Phenols (Total)	Arsenic	Cadmium	Chromium	Lead	Mercury	Selenium
437496	BH 1 A	4.9	26	0.23	<0.0008	<0.05	0.52	<0.05	0.000041	<0.0003
437503	BH 1 B	6.2	19	0.12	<0.0008	<0.05	0.27	<0.05	0.00006	<0.0003
437497	BH 2 A	8.7	25	0.10	0.0054	<0.05	0.96	<0.05	<0.02	0.0023
437504	BH 2 B	4.6	140	0.59	<0.0008	<0.05	0.90	<0.05	<0.02	0.0024
437498	BH 3 A	6.4	19	<0.05	0.0076	<0.05	0.37	<0.05	<0.02	<0.0003
437505	BH 3 B	6.3	17	0.19	0.0047	<0.05	0.28	<0.05	<0.000005	<0.0003
437499	BH 4 A	6.5	62	0.14	<0.0008	<0.05	0.13	<0.05	<0.000005	<0.0003
437506	BH 4 B	7.2	67	0.15	<0.0008	<0.05	0.38	<0.05	0.0000395	<0.0003
437500	BH 5 A	2.5	61	0.15	0.30	0.22	5.6	0.07	<0.02	0.0044
437501	BH 6 A	2.1	8.9	0.11	0.19	0.14	3.5	<0.05	<0.02	<0.0003
437507	BH 6 B	2.5	5.4	0.09	0.0056	0.12	2.8	<0.05	0.000042	<0.0003
438193	BH 7 A	5.8	20	<0.05	0.0025	0.06	1.3	<0.05	0.0039	0.0007
438199	BH 7 B	5.7	18	<0.05	0.0014	0.06	1.5	<0.05	0.0002	<0.0003

Signed Mr B E Francis, Contracts Manager

Page 1 of 1

Northumberland Dock Road
Wallsend
Tyne Wear
NE28 0QD
Tel: 0191 2950833
Fax: 0191 2956169

CERTIFICATE OF ANALYSIS

Client: PRO-SOIL SURVEYS LTD.
Contract: PROSOIL-0413
97343 ROYSTON/07/9138

Sample I.D No.	Sample Description	pH	Cyanide (Free) mg/Kg	Cyanide (Complex) mg/Kg	Phenols mg/Kg	Arsenic mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Lead mg/Kg	Mercury mg/Kg	Selenium mg/Kg
436004	BH1 0.5M	3.1	<1	8400	2	60	<0.5	58	550	1.7	<0.5
436005	BH1 1.0-1.45M	5.2	<1	810	1	14	<0.5	47	28	0.4	<0.5
436006	BH1 2.0-2.45M	3.9	<1	28	2	<3	<0.5	18	14	<0.2	<0.5
436007	BH1 3.75M	5.9	<1	18	1	<3	<0.5	17	14	<0.2	1.5
436008	BH1 4.5M	5.4	<1	13	3	<3	<0.5	32	44	<0.2	<0.5
436009	BH1 5.25-5.9M	6.5	<1	7	4	<3	<0.5	32	21	<0.2	1.0
436010	BH2 0.5M	5.9	<1	91	5	69	2.0	23	83	0.2	1.0
436011	BH2 1.0-1.45	5.9	<1	92	5	69	2.5	25	96	0.2	<0.5
436012	BH2 2.5M	4.7	<1	10	2	11	<0.5	13	20	<0.2	<0.5
436013	BH2 3.75M	5.6	<1	12	3	<3	<0.5	29	20	<0.2	<0.5
436014	BH3 0.5M	5.5	<1	620	3	<3	<0.5	32	23	<0.2	<0.5
436015	BH3 1.0-1.45M	6.8	<1	3	<1	<3	<0.5	17	15	<0.2	<0.5
436016	BH3 2.75M	5.5	<1	6	3	<3	<0.5	15	13	<0.2	<0.5
436017	BH3 3.75M	7.1	<1	8	5	<3	<0.5	34	28	<0.2	1.0
436018	BH4 0.5M	4.7	<1	840	5	41	<0.5	38	200	0.3	<0.5
436019	BH4 1.75M	9.3	<1	98	6	10	<0.5	34	53	<0.2	<0.5
436020	BH4 3.0-3.45	6.8	<1	41	2	<3	<0.5	32	25	<0.2	<0.5
436021	BH4 4.0-4.45M	6.5	<1	9	5	<3	<0.5	31	35	<0.2	<0.5
436022	BH5 0.5M	4.6	<1	800	<1	57	<0.5	52	64	<0.2	2.5
436023	BH5 1.0-1.45M	4.1	<1	1100	<1	58	<0.5	45	39	<0.2	8.5
436024	BH5 2.75M	3.9	<1	83	<1	<3	<0.5	15	11	<0.2	<0.5
436025	BH5 3.75M	3.8	<1	2	1	<3	0.5	31	25	<0.2	<0.5
436026	BH6 0.5M	4.3	<1	11	2	21	<0.5	23	120	<0.2	1.0
436027	BH6 1.5M	3.5	<1	41	<1	<3	<0.5	13	9	<0.2	<0.5
436028	BH6 2.0-2.45M	4.1	<1	3	<1	<3	0.5	33	28	<0.2	<0.5
436029	TP1 1.5M	5.9	<1	20	<1	130	<0.5	28	43	<0.2	<0.5
436030	TP1 3.7M	6.5	<1	10	<1	160	<0.5	51	45	<0.2	<0.5
436031	TP2 1.2M	6.8	<1	26	<1	180	<0.5	47	85	<0.2	<0.5
436032	TP2 5.8M	4.4	<1	3	1	20	<0.5	18	35	<0.2	1.0
436033	TP2 5.8M	0.3	<1	1	<1	5	<0.5	35	27	<0.2	<0.5
436034	TP3 0.9M	6.4	<1	17	<1	41	<0.5	45	59	<0.2	<0.5
436035	TP3 3.0M	6.3	<1	81	<1	44	<0.5	28	21	<0.2	<0.5
436036	TP3 4.3M	7.6	<1	<1	<1	<3	<0.5	32	33	<0.2	<0.5
436037	TP4 1.0M	5.5	<1	200	<1	75	<0.5	34	39	0.2	0.5
436038	TP5 0.3M	5.7	<1	17	<1	42	<0.5	25	51	<0.2	4.0

Northumberland Dock Road
Wallsend
Tyne Wear
NE28 0DD
Tel. 0191 2950833
Fax. 0191 2955169

Signed  Mr B E Francis, Contracts Manager

Page 1 of 2

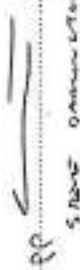
Save as attachment

CERTIFICATE OF ANALYSIS

Client: PRO-SOIL SURVEYS LTD.
Contract: PROSOIL-0413
Job No: 97343 ROYSTON/7/0138

Sample I.D. No.	Sample Description	pH	Cyanide (Free) mg/Kg	Cyanide (Complex) mg/Kg	Phenols mg/Kg	Arsenic mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Lead mg/Kg	Mercury mg/Kg	Selenium mg/Kg
436039	TP5 0.95M	6.2	<1	1	1	7	<0.5	18	29	<0.2	1.0
436040	TP5 2.0M	6.1	<1	<1	2	19	<0.5	36	47	<0.2	<0.5
436041	TP5A 0.2-1.0M	5.0	<1	330	3	86	<0.5	9	62	0.4	5.5
436042	TP6 0.4M	3.7	<1	500	<1	55	<0.5	22	26	<0.2	18.0
436043	TP6 1.1M	5.4	<1	6	2	<3	<0.5	17	15	<0.2	<0.5
436044	TP7 0.3M	2.4	<1	10	<1	14	<0.5	17	26	<0.2	2.5
436045	TP7 0.9M	5.9	<1	<1	<1	3	<0.5	10	7	<0.2	<0.5
436046	TP7 1.1M	6.4	<1	<1	2	<3	<0.5	34	23	<0.2	<0.5

Northumberland Dock Road
Wallsend
Tyne Wear
NE28 0QD
Tel: 0191 2950833
Fax: 0191 2955169

Signed:  Mr B E Francis, Contracts Manager

5 Nov 2004

APPENDIX D ICRCL 59/83 (second edition) Tables 3 and 4

CONDITIONS

1. This table is invalid if reproduced without the conditions and footnotes.
2. All values are for concentrations determined on "spot" samples based on an adequate site investigation carried out prior to development. They do not apply to analysis of averaged, bulked or composited samples, nor to sites which have already been developed. All proposed values are tentative.
3. The lower values in Group A are similar to the limits for metal content of sewage sludge applied to agricultural land.
- 3(b). The values in Group B are those above which phytotoxicity is possible.
4. If all sample values are below the threshold concentrations then the site may be regarded as uncontaminated as far as the hazards from these contaminants are concerned, and development may proceed. Above these concentrations, remedial action may be needed, especially if the contamination is still continuing. Above the action concentration, remedial action will be required or the form of development changed.

Contaminants	Planned uses	Trigger concentrations (mg/kg air dried soil)	
		Threshold	Action
<u>Group A: Contaminants which may pose hazards to health</u>			
Arsenic	Domestic gardens, allotments	10	*
	Parks, playing fields, open space	40	*
Cadmium	Domestic gardens, allotments	3	*
	Parks, playing fields, open space	15	*
Chromium (hexavalent) (1)	Domestic gardens, allotments Parks, playing fields, open space	25	*
Chromium (total)	Domestic gardens, allotments	600	*
	Parks, playing fields, open space	1,000	*
Lead	Domestic gardens, allotments	500	*
	Parks, playing fields, open space	2,000	*
Mercury	Domestic gardens, allotments	1	*
	Parks, playing fields, open space	20	*
Selenium	Domestic gardens, allotments	3	*
	Parks, playing fields, open space	6	*
<u>Group B: Contaminants which are phytotoxic but not normally hazards to health</u>			
Boron (water-soluble) (3)	Any use where plants are to be grown (2, 6)	3	*
Copper (4, 5)	Any use where plants are to be grown (2, 6)	130	*
Nickel (4, 5)	Any use where plants are to be grown (2, 6)	70	*
Zinc (4, 5)	Any use where plants are to be grown (2, 6)	300	*

NOTES:

- * Action concentrations will be specified in the next edition of ICRCL 59/83.
1. Soluble hexavalent chromium extracted by 0.1M HCl at 37°C; solution adjusted to pH 1.0 if alkaline substances present.
2. The soil pH value is assumed to be about 6.5 and should be maintained at this value. If the pH falls, the toxic effects and the uptake of the elements will be increased.
3. Determined by standard ADAS method (soluble in hot water).
4. Total concentration (extractable by HNO₃/HClO₄).
5. The phytotoxic effects of copper, nickel and zinc may be additive. The trigger values given here are those applicable to the 'worst-case': phytotoxic effects may occur at these concentrations in acid, sandy soils. In neutral or alkaline soils phytotoxic effects are unlikely at these concentrations.
6. Grass is more resistant to phytotoxic effects than are most other plants and its growth may not be adversely affected at these concentrations.

NOTES

This table is invalid if reproduced without the conditions and footnotes.

All values are for concentrations determined on "spot" samples based on an adequate site investigation carried out prior to development. They do not apply to analysis of averaged, bulked or composited samples, nor to sites which have already been developed.

Many of these values are preliminary and will require regular updating. They should not be applied without reference to the current edition of the report "Problems Arising from the Redevelopment of Gasworks and Similar Sites".

If all sample values are below the threshold concentrations then the site may be regarded as uncontaminated as far as the hazards from these contaminants are concerned, and development may proceed. Above these concentrations, remedial action may be needed, especially if the contamination is still continuing. Above the action concentration, remedial action will be required or the form of development changed.

Contaminants	Proposed uses	Trigger concentrations (mg/kg air dried soil)	
		Threshold	Action
Aromatic hydrocarbons	(1, 2) Domestic gardens, allotments, play areas.	50	500
	Landscaped areas, buildings, hard cover.	1,000	10,000
Benzene	Domestic gardens, allotments.	5	200
	Landscaped areas, buildings, hard cover.	5	1,000
Carbon disulphide	Domestic gardens, allotments, landscaped areas.	25	500
	Buildings, hard cover.	100	500
Hexachlorocyanides	Domestic gardens, allotments.	250	1,000
	Landscaped areas	250	5,000
	Buildings, hard cover.	250	NL
Phenol (2)	All proposed uses.	50	NL
Polynuclear aromatic hydrocarbons	Domestic gardens, allotments, landscaped areas.	2,000	10,000
	Buildings (3).	2,000(3)	50,000(3)
	Hard cover.	2,000	NL
Lead	All proposed uses.	250	1,000
Mercury	All proposed uses.	5,000	20,000
pH (pH less than)	Domestic gardens, allotments, landscaped areas.	pH5	pH3
	Buildings, hard cover.	NL	NL

5:

No limits set as the contaminant does not pose a particular hazard for this use.

Used here as a marker for coal tar, for analytical reasons. See "Problems Arising from the Redevelopment of Gasworks and Similar Sites" Annex A1.

See "Problems Arising from the Redevelopment of Gasworks and Similar Sites" for details of analytical methods.

See also BRE Digest 250: Concrete in sulphate-bearing soils and groundwater.

24 JAN 2001

ENVIRONMENTAL ANALYSIS LTD

15 Burgess Road, Ivyhouse Lane Industrial Estate, Haslingde, East Sussex TN35 4NR
Tel: 01424 444433 Fax: 01424 442280 info@environmentalanalysis.com

ANALYTICAL REPORT NO. R53610

Location: Monokton Coke Works - Gas Purification Plant

CLIENT: Allied Exploration & Geotechnics Ltd

Unit 25, Sierra Gull Ind Estate, Pelton Fell
Chester Le Street, County Durham DH2 2PU

Your Order No: 22611
Your Job No: 3146
Reporting Date: 23/01/01

F.A.O.	Michelle Selkirk	TF/BN	BH1/CH	BH1/CH	BH2/CH	BH2/CH	BH3/CH	BH3/CH	BH4/CH	BH4/CH	BH5/CH	BH5/CH
		Depth (m)	GL	3.60	1.00	6.00	3.00	5.00	0.50	5.00	1.00	3.00
		Our ref	80275	80275	79949	79954	79955	79967	80268	80273	79479	79481
Soils												
Arsenic	(mg/kg)	N	53.6	<5	12.4	<5	6.9	<5	12.2	6.8	10.1	<5
Cadmium	(mg/kg)	N	1.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	(mg/kg)	N	23	20	19	18	26	28	16	10	24	30
Copper	(mg/kg)	N	59	40	15	101	29	44	16	82	29	30
Nickel	(mg/kg)	N	9	54	15	37	18	45	41	20	35	59
Lead	(mg/kg)	N	4964	34	15	35	22	30	20	40	24	18
Mercury	(mg/kg)	N	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5
Zinc	(mg/kg)	N	24	115	44	57	28	112	112	70	63	120
pH	(Value)	N	3.5	7.4	2.9	6.5	4.8	6.2	5.5	7.5	5.4	5.8
Total Sulphate	(mg/kg)	N	5850.4	9800	10500	4100	7500	4800	10400	5200	4300	700
Complex Cyanide	(mg/kg)	N	25928.0	11.7	65.1	14.6	9.0	16.5	14.9	6.2	46.7	21.9
Total Cyanide	(mg/kg)	N	26000.0	13.2	68.0	16.0	10.0	18.0	16.8	6.2	48.0	23.0
Free Cyanide	(mg/kg)	N	72.0	1.5	2.9	1.4	1.0	1.5	1.9	0.0	1.3	1.1
Sulphide	(mg/kg)	N	8.8	<2	<2	<2	<2	<2	9.9	<2	<2	<2
Ammonical Nitrogen	(mg/kg)	N	21.80	13.90	63.60	24.40	143.74	68.09	78.00	73.50	85.40	32.40
Total PAH	(mg/kg)	N	5.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thiophenol	(mg/kg)	N	84	14	54.4	29	44	496	224	578	6	784
Catechol	(mg/kg)	N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Resorcinol	(mg/kg)	N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbazole	(mg/kg)	N	0.1	0.1	0.3	<0.1	0.2	<0.1	1.6	0.4	0.1	0.1
Xylenols & Ethylphenols	(mg/kg)	N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthols	(mg/kg)	N	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1
Phenol	(mg/kg)	N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trimethylphenol	(mg/kg)	N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Phenols	(mg/kg)	N	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.9	0.5	<0.5	<0.5
Total Petroleum Hydrocarbons	(mg/kg)	N	<0.1	<0.1	4.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analysis not possible due to matrix interference

Checked by:

SK

C.P.V. Knight

www.environmentalanalysis.com

Descriptions of methods & performance data available on request (N/A)
N = N/A/MS accredited test
Other tests not accredited

ENVIRONMENTAL ANALYSIS LTD

15 Burgess Road, Ivyhouse Lane Industrial Estate, Haslingde, East Sussex TN35 4NR
Tel: 01424 444433 Fax: 01424 442299 info@environmentalanalysis.com

ANALYTICAL REPORT NO. R53610

Location: Monckton Coke Works - Gas Purification Plant

CLIENT: Allied Exploration & Geotechnics Ltd

Unit 25, Stella Gill Ind Estate, Pelton Fell
Chester Le Street, County Durham, DH2 2PU

Your Order No: 22611
Your Job No: 3146
Reporting Date: 23/01/01

F.A.O: Michelle Seikirk

Soils

TP/BH	BHE/CH	BHE/CH	BHE/CH	BHT/CH	BHT/CH	Spot/SS1	Spot/SS2	Spot/SS3	Spot/SS4	Spot/SS5
Depth (m)	Cur ref	80512	80516	80519	80521	79720	79718	79722	79721	79717
Asenic	(mg/kg) N	5.1	13.5	15.3	32.3	6.4	27.2	18.2	75.5	33.5
Cadmium	(mg/kg) N	<0.5	<0.5	0.6	1.1	<0.5	0.9	0.6	1.9	0.9
Chromium	(mg/kg) N	29	10	34	38	31	125	44	22	85
Copper	(mg/kg) N	30	16	35	94	50	127	118	40	122
Nickel	(mg/kg) N	44	6	60	61	39	41	13	20	11
Lead	(mg/kg) N	19	12	22	82	39	114	129	36	272
Mercury	(mg/kg) N	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	(mg/kg) N	105	27	109	139	103	138	19	29	82
pH	(Value)	6.7	5.0	6.6	7.1	6.7	2.2	2.5	2.2	2.9
Total Sulphate	(mg/kg) N	1200	8713	18800	3000	4100	83900	48900	71500	81000
Complex Cyanide	(mg/kg) N	3.6	5.8	4.5	188.3	8.6	10000.0	3068.0	10700.0	10320.0
Total Cyanide	(mg/kg) N	3.6	5.8	4.5	190.0	8.6	10400.0	3200.0	11200.0	10600.0
Free Cyanide	(mg/kg) N	<1	<1	<1	3.7	<1	400.0	132.0	440.0	480.0
Sulphide	(mg/kg) N	<2	17.4	<2	<2	<2	4.4	25.6	4.4	11.2
Ammonical Nitrogen	(mg/kg) N	15.96	64.80	86.67	46.15	30.09	119.09	36.16	15.31	79.11
Total PAH	(mg/kg) N	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thiophenole	(mg/kg) N	<2	124	256	#	544	#	#	#	#
Catechol	(mg/kg) N	0.3	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1
Resorcinol	(mg/kg) N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cresols	(mg/kg) N	<0.1	<0.1	<0.1	0.3	0.1	<0.1	<0.1	<0.1	<0.1
Xylenols & Ethylphenols	(mg/kg) N	1.0	0.3	0.1	0.1	<0.1	<0.1	<0.1	0.3	<0.1
Naphthols	(mg/kg) N	0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenol	(mg/kg) N	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trimethylphenol	(mg/kg) N	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Phenols	(mg/kg) N	2.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons	(mg/kg) N	<0.1	498.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analysis not possible due to matrix interference

Descriptions of methods & performance data available on request (V8)
N = N/AAS accredited test
Other tests not accredited

Checked by:

SK

C.P.V. Knight

www.environmentalanalysis.com

Environmental Analysis Ltd. Registered in England no. 2369445. Reg. Office 13 Station Road London N2 2SQ.
Directors: C.P.V. Knight BSc Environ Chem FRSC, C.A. Knight, S.M.V. Knight, B.A. Perry.

ENVIRONMENTAL ANALYSIS LTD

15 Burgess Road, Ivyhouse Lane Industrial Estate, Hastings, East Sussex TN36 4NR
Tel: 01424 444433 Fax: 01424 442289 info@environmentalanalysis.com

ANALYTICAL REPORT No. R53610

Location: Merckton Coke Works - Gas Purification Plant

CLIENT: Allied Exploration & Geotechnics Ltd

Unit 25, Stella Gill Ind Estate, Pelton Fell
Chester Le Street, County Durham DH2 2RU

Your Order No: 22611
Your Job No: 3146
Reporting Date: 23/01/01

F.A.O.	Michelle Selkirk	TP/BH	Spot/SSS	SS7	SS8	TP1	TP1/CH7	TP2/CH1	TP2/CH4	TP3/CH2	TP4/CH4	TP5/CH2
		Depth (m)	79719	79356	79367	78725	79370	78454	79456	79372	79374	79382
Soils		Our ref										
Arsenic	(mg/kg)	N	24.9	9.2	10.1	225.1	6.8	22.7	30.2	99.9	13.9	125.8
Cadmium	(mg/kg)	N	1.2	0.8	<0.5	5.6	0.6	<0.5	1.2	2.0	0.5	4.7
Chromium	(mg/kg)	N	57	20	19	67	36	20	27	18	32	13
Copper	(mg/kg)	N	131	34	33	84	35	22	48	24	30	69
Nickel	(mg/kg)	N	13	23	13	129	31	39	35	61	43	22
Lead	(mg/kg)	N	195	345	135	57	26	31	35	30	25	37
Mercury	(mg/kg)	N	0.8	0.8	<0.5	<0.5	<0.5	0.7	1.1	0.8	0.5	<0.5
Zinc	(mg/kg)	N	57	57	23	105	52	116	54	61	63	17
pH	(Value)	N	2.2	11.3	11.3	4.0	5.4	5.5	3.4	6.1	4.4	4.7
Total Sulphate	(mg/kg)	N	86700	6023	9531	43600	4400	33495	10100	21500	3000	24800
Complex Cyanide	(mg/kg)	N	4040.0	748.0	486.0	31.8	2.7	79.6	24.6	9.0	12.1	6.2
Total Cyanide	(mg/kg)	N	4600.0	820.0	480.0	34.0	2.7	86.0	30.0	9.0	13.6	6.2
Free Cyanide	(mg/kg)	N	360.0	72.0	24.0	2.4	<1	6.4	5.4	<1	1.5	<1
Sulphide	(mg/kg)	N	<2	<2	<2	9.9	<2	<2	<2	44.9	11.2	<2
Ammoniacal Nitrogen	(mg/kg)	N	68.47	22.80	16.70	115.57	138.80	26.90	73.30	172.50	160.30	29.58
Total PAH	(mg/kg)	N	<0.5	23.7	11.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.4
Thiophenols	(mg/kg)	N	#	#	#	#	#	4	<2	688	752	<2
Catechol	(mg/kg)	N	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	<0.1
Resorcinol	(mg/kg)	N	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1
Cresols	(mg/kg)	N	<0.1	<0.1	<0.1	<0.1	0.2	0.4	0.2	4.6	0.6	<0.1
Xylenols & Ethylphenols	(mg/kg)	N	<0.1	0.4	0.3	<0.1	0.7	1.4	0.2	1.9	<0.1	<0.1
Naphthols	(mg/kg)	N	<0.1	<0.1	<0.1	<0.1	0.2	0.4	<0.1	0.8	<0.1	<0.1
Phenol	(mg/kg)	N	0.2	0.8	0.1	<0.1	0.3	0.5	0.1	1.1	<0.1	<0.1
Trimethylphenol	(mg/kg)	N	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	1.1	<0.1	<0.1
Total Phenols	(mg/kg)	N	<0.5	1.2	<0.5	<0.5	1.6	3.1	<0.5	10.9	0.7	<0.5
Total Petroleum Hydrocarbons	(mg/kg)	N	<0.1	42.6	13.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	699.9
				10-30	10-30							10-30

Descriptions of methods & performance data available on request (V9)

N = NAAQS accredited test

Other tests not accredited

www.environmentalanalysis.com

Checked by:

SK

C.P.V. Knight

Analysis not possible due to matrix interference
* Typical of Diesel Range Organics and heavier hydrocarbons

ENVIRONMENTAL ANALYSIS LTD

15 Burgess Road, Ivyhouse Lane Industrial Estate, Hastings, East Sussex TN35 4NR
Tel: 01424 444533 Fax: 01424 442288 info@environmentalanalysis.com

ANALYTICAL REPORT NO. R53610

Location: Monckton Coke Works - Gas Purification Plant

CLIENT: Allied Exploration & Geotechnics Ltd

Unit 25, Stella Gill Ind Estate, Pelton Fell
Chester Le Street, County Durham DH2 2RU

Your Order No: 22611
Your Job No: 3146
Reporting Date: 23/01/01

F.A.O: Michelle Seikink

Soils

	TP10H	TP6UCH2	TP7UCH6	TP6UCH3	TP6UCH5	TP6UCH1	TP10UCH1	TP11UCH2	TP11UCH5	TP12UCH2
Depth (m)	0.40	1.60	1.60	0.85	2.95	0.20	0.50	1.50	3.00	0.80
Our ref	79365	79385	79385	79466	79469	79472	79362	79461	79464	79474
Arsenic (mg/kg) N	65.6	17.9	<0.5	<0.5	7.7	22.5	<0.5	6.4	16.7	11.8
Cadmium (mg/kg) N	1.8	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5
Chromium (mg/kg) N	27	31	31	19	38	18	4	17	35	22
Copper (mg/kg) N	81	65	65	18	32	51	6	18	33	14
Nickel (mg/kg) N	30	19	19	14	81	21	4	28	56	16
Lead (mg/kg) N	70	30	30	17	21	521	30	20	28	24
Mercury (mg/kg) N	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	0.5	<0.5
Zinc (mg/kg) N	99	56	56	50	96	229	22	55	103	53
pH (Value) N	4.4	5.4	6.5	7.3	9.7	11.5	7.9	8.2	6.9	6.9
Total Sulphate (mg/kg) N	17100	3300	400	400	5567	2455	819	400	600	600
Complex Cyanide (mg/kg) N	51.1	2.8	3.8	2.9	105.2	25.5	3.7	1.8	2.4	2.4
Total Cyanide (mg/kg) N	54.0	2.8	3.8	2.9	112.0	28.0	3.7	1.8	2.4	2.4
Free Cyanide (mg/kg) N	2.9	<1	<1	<1	5.8	2.5	<1	<1	<1	<1
Sulphide (mg/kg) N	<2	8.4	<2	<2	<2	<2	<2	<2	<2	<2
Ammonical Nitrogen (mg/kg) N	38.40	39.50	44.40	24.80	10.90	15.30	11.20	25.50	15.20	15.20
Total PAH (mg/kg) N	4.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thiocyantate (mg/kg) N	<2	#	<2	394	<2	16	<2	<2	<2	<2
Catechol (mg/kg) N	<0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Resorcinol (mg/kg) N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cresols (mg/kg) N	<0.1	<0.1	0.2	0.2	<0.1	0.4	<0.1	<0.1	<0.1	<0.1
Xylenes & Ethylphenols (mg/kg) N	0.3	0.1	1.4	0.4	0.1	0.3	0.2	0.1	1.0	<0.1
Naphthols (mg/kg) N	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenol (mg/kg) N	<0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1
Trimethylphenol (mg/kg) N	<0.1	<0.1	0.1	0.2	<0.1	<0.1	<0.1	<0.1	0.8	<0.1
Total Phenols (mg/kg) N	<0.5	<0.5	2.2	0.9	<0.5	<0.5	<0.5	<0.5	3.8	<0.5
Total Petroleum Hydrocarbons (mg/kg) N	4.5	315.1	<0.1	<0.1	73.8	62.4	<0.1	<0.1	<0.1	<0.1
	*18-30	*10-30					*10-30			

Descriptions of methods & performance data available on request (V8)
N = N/A/MS accredited test
Other tests not accredited

www.environmentalanalysis.com

Analysis not possible due to matrix interference
* Typical of Diesel Range Organics and heavier hydrocarbons

Checked by:

SK

C.P.V. Knight

ENVIRONMENTAL ANALYSIS LTD

15 Burgess Road, Ivyhouse Lane Industrial Estate, Hasling, East Sussex TN35 4NR
Tel: 01424 414433 Fax: 01424 442299 Info: environmentalanalysis@bt.com

ANALYTICAL REPORT No. R53610

Location: Monckton Coke Works - Gas Purification Plant

CLIENT: Allied Exploration & Geotechnics Ltd

Unit 25, Sista Giff Ind Estate, Pelton Fell
Chester Le Street, County Durham DH2 2FU

Your Order No: 22611
Your Job No: 3146
Reporting Date: 23/01/01

F.A.O:	TP/BH	BH1	BH2/CH	BH3	Sump 1	Sump 2	Sump 3	Sump 4	SW6	TP1 WB	TP3
Water	Depth (m)	4.00	0.20	0.20	80528	80527	80528	80528	80290	1.70	0.80
	Cur ref	80291	79947	79961	80528	80527	80528	80528	80290	78713	78716
Arsenic	(mg/l) N	<0.01	0.018	0.016	<0.01	<0.01	<0.01	<0.01	0.072	0.078	0.019
Cadmium	(mg/l) N	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.001	<0.001
Chromium	(mg/l) N	<0.02	0.020	<0.02	<0.02	<0.02	<0.02	<0.02	0.348	<0.02	<0.02
Copper	(mg/l) N	<0.02	0.012	<0.02	<0.02	<0.02	<0.02	<0.02	0.147	<0.02	<0.02
Nickel	(mg/l) N	0.040	1.342	0.114	0.028	0.023	0.042	<0.02	0.593	0.396	0.095
Lead	(mg/l) N	<0.02	<0.02	<0.02	<0.02	<0.02	0.096	<0.02	0.291	<0.02	<0.02
Mercury	(mg/l) N	<0.0001	0.0015	0.0017	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0008	0.0012
Selenium	(mg/l) N	<0.01	0.016	0.087	<0.01	<0.01	<0.01	<0.01	<0.01	0.084	0.092
Zinc	(mg/l) N	0.487	4.061	0.267	0.262	0.202	0.234	0.152	1.801	0.221	0.418
pH	(Value) N	5.8	3.6	5.1	6.4	4.6	3.8	6.2	2.3	4.6	5.7
Sulphate	(mg/l) N	2655	2847	1582	870	363	515	477	3800	2846	1885
Total Cyanide	(mg/l) N	2.875	0.525	0.425	1.300	1.400	0.600	0.070	0.650	7.500	1.100
Free Cyanide	(mg/l) N	0.030	0.050	0.025	<0.005	0.010	0.018	<0.005	0.050	1.750	0.100
Suphride	(mg/l) N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total PAH	(mg/l) N	0.023	0.017	0.043	0.016	0.077	0.018	0.007	1.437	0.514	0.016
Thiocyanate	(mg/l) N	23.5	<0.1	<0.1	145.0	60.0	85.0	<0.1	4.6	1100.0	2.8
Catechol	(mg/l) N	<0.0001	0.0524	<0.1	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Resorcinol	(mg/l) N	<0.0001	<0.0001	0.0040	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Creosols	(mg/l) N	0.0136	0.0316	0.0700	<0.0001	0.0048	<0.0001	<0.0001	<0.0001	0.2180	<0.0001
Xylenols & Ethylphenols	(mg/l) N	<0.0001	0.0725	0.0875	<0.0001	0.0086	<0.0001	<0.0001	<0.0001	0.1544	0.0001
Naphthols	(mg/l) N	<0.0001	0.0029	0.0058	<0.0001	0.0014	<0.0001	<0.0001	<0.0001	0.0109	<0.0001
Phenol	(mg/l) N	<0.0001	<0.0001	0.0697	<0.0001	0.0058	<0.0001	<0.0001	<0.0001	0.4504	0.0003
Trimethylphenol	(mg/l) N	<0.0001	0.0108	0.0118	<0.0001	0.0062	<0.0001	<0.0001	<0.0001	0.0147	<0.0001
Total Phenols	(mg/l) N	0.0136	0.1704	0.2488	<0.0005	0.0829	<0.0005	<0.0005	<0.0005	0.8464	0.0005
Aromatized Nitrogen	(mg/l) N	15.00	240.00	110.00	900.00	490.00	260.00	<0.005	34.00	380.00	240.0
Total Petroleum Hydrocarbons	(mg/l) N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	12.24	<0.1

Typical of diesel range organics

Method of analysis & performance data available on request (V10)
N = N/A/US not tested
Other tests not specified

Checked by:

SK

C.P.V. Knight

www.environmentalanalysis.com

Environmental Analysis Ltd. Registered in England no. 2889445. Reg. Office 13 Station Road London N3 2SB.
Directors: C.P.V. Knight BSc. EChem. Chem. FRSC. C.A. Knight, S.M.V. Knight, B.M. Perry.

ENVIRONMENTAL ANALYSIS LTD

15 Burgess Road, Ivyhouse Lane Industrial Estate, Hastings, East Sussex TN35 4NR
Tel: 01424 444333 Fax: 01424 442288 info@environmentalanalysis.com

ANALYTICAL REPORT NO. R53610

Location: Monckton Coke Works - Gas Purification Plant

CLIENT: Allied Exploration & Geotechnics Ltd

Unit 25, Stella Gill Ind Estate, Felton Fell
Chester Le Street, County Durham DH2 2RJ

Your Order No: 22611
Your Job No: 3146
Reporting Date: 23/01/01

F.A.O:	Michelle Selkirk	TP3H	TP3W3	TP4 W6	TP5W3	TP6W5	TP7W5	TP10W2	TP11W3	TP12W4
Waters		Depth (m)	Cur rel	78714	79359	79350	79361	79358	79462	79476
Arsenic	(mg/l) N	0.012	0.019	0.233	<0.01	<0.01	<0.01	0.010	0.010	<0.01
Cadmium	(mg/l) N	<0.001	<0.001	0.007	0.008	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	(mg/l) N	<0.02	<0.02	0.384	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Copper	(mg/l) N	<0.02	0.281	0.312	0.024	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	(mg/l) N	0.111	0.487	0.730	0.248	0.029	0.029	<0.02	<0.02	<0.02
Lead	(mg/l) N	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.001	0.000	0.000
Mercury	(mg/l) N	0.000	0.000	0.001	0.000	0.000	0.000	<0.01	<0.01	<0.01
Selenium	(mg/l) N	<0.01	0.043	0.013	0.013	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	(mg/l) N	0.359	0.034	5.206	2.241	0.578	0.054	0.090	0.150	0.150
pH	(value) N	3.6	10.0	3.9	5.1	6.0	2.4	9.0	7.5	
Sulphate	(mg/l) N	2089	1028	6533	2570	641	218	921	1053	
Total Cyanide	(mg/l) N	6.800	16.500	7.400	17.500	0.100	2.050	5.000	4.250	
Free Cyanide	(mg/l) N	1.350	8.000	0.380	0.205	0.020	0.110	0.025	0.020	
Sulphide	(mg/l) N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Total PAH	(mg/l) N	8.040	2.082	19.880	10.500	<0.001	87.150	<0.001	0.340	
Thioacetate	(mg/l) N	1800.0	2100.0	1700.0	550.0	0.8	10.5	9.4	9.0	
Catechol	(mg/l) N	0.0132	<0.0001	0.0116	0.0119	<0.0001	0.2448	0.0767	<0.0001	
Resorcinol	(mg/l) N	<0.0001	0.6596	<0.0001	<0.0001	<0.0001	0.0469	<0.0001	0.0013	
Cresols	(mg/l) N	0.1686	0.1459	0.0124	0.0023	<0.0001	0.1366	0.0418	0.0048	
Xylenols & Ethylphenols	(mg/l) N	0.1442	0.0785	0.0035	0.0046	0.0089	0.2215	0.0624	0.0094	
Naphthols	(mg/l) N	0.0078	0.0070	<0.0001	0.0015	0.0207	0.0045	0.0034	0.0035	
Phenol	(mg/l) N	0.2260	1.3267	<0.0001	<0.0001	<0.0001	0.2979	0.1286	0.0071	
Trimethylphenol	(mg/l) N	0.0283	0.0517	0.0024	0.0081	0.0038	0.0514	0.0163	0.0052	
Total Phenols	(mg/l) N	0.5891	2.2696	0.0299	0.0284	0.0344	1.0086	0.3492	0.0313	
Ammonical Nitrogen	(mg/l) N	440.00	250.00	640.00	280.00	21.00	14.00	10.80	14.00	
Total Petroleum Hydrocarbons	(mg/l) N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	

Methods of analysis & performance data available on request (V8)
N = NATAAS accredited test
Other tests not accredited

www.environmentalanalysis.com

Checked by:

SK

C.P.V. Knight

ENVIRONMENTAL ANALYSIS LTD

15 Burgess Road, Ivyhouse Lane Industrial Estate, Hasling, East Sussex TN35 4NR
Tel: 01424 444433 Fax: 01424 442299 Info@environmentalanalysis.com

ANALYTICAL REPORT NO. R53610

Location: Monckton Coke Works - Gas Purification Plant

CLIENT: Allied Exploration & Geotechnics Ltd

Unit 25, Stella Gill Ind Estate, Pelton Fell
Chester Le Street, County Durham DH2 2PU

F.A.O: Michelle Selkirk

Water

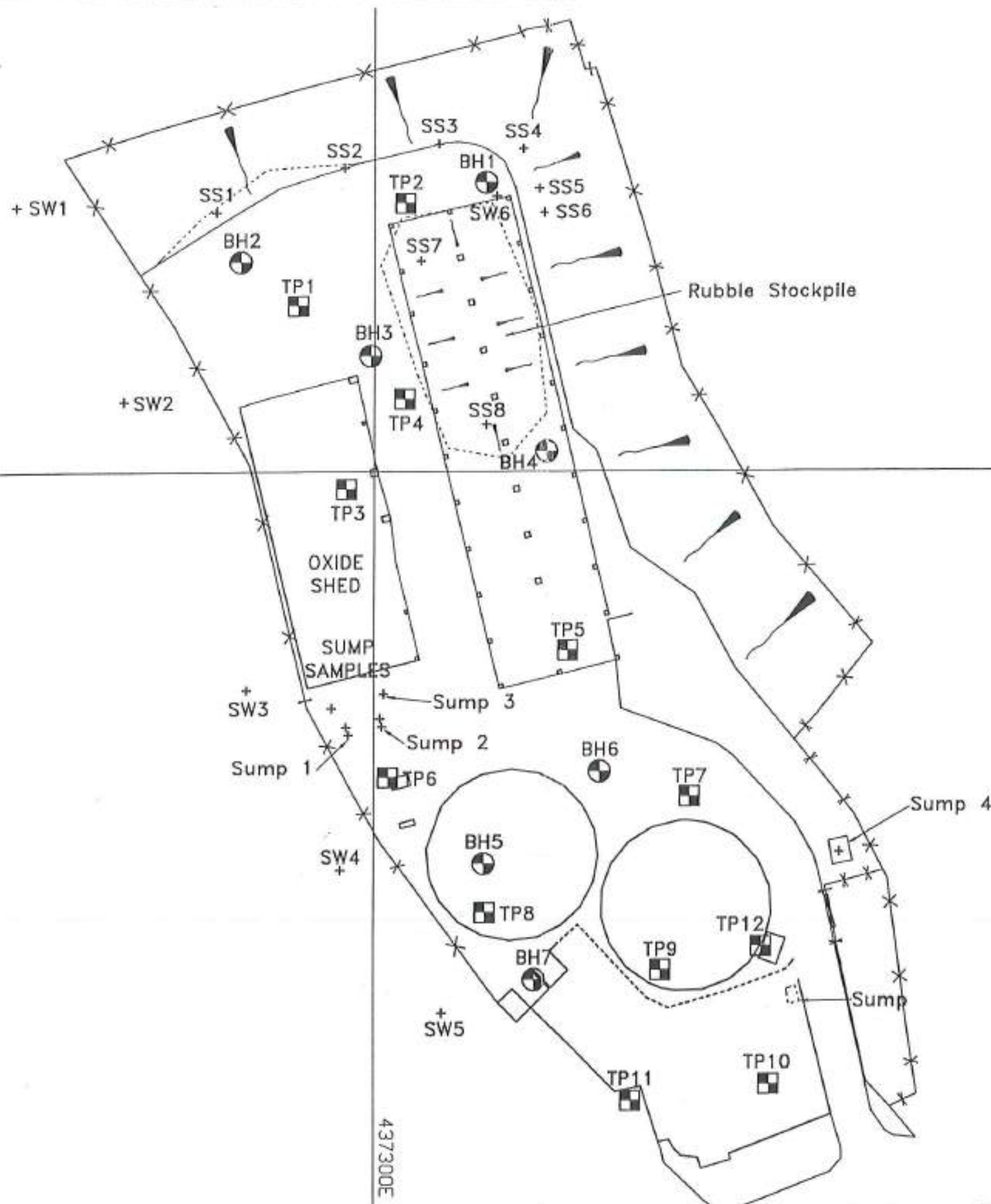
	TP/BN Our ref	SW1 79351	SW2 79352	SW3 79353	SW4 79354	SW5 79355	SW7 80524	SW8 80525
Arsenic	(mg/l) N	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	(mg/l) N	<0.001	0.001	0.001	0.001	0.001	<0.001	<0.001
Chromium	(mg/l) N	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Copper	(mg/l) N	<0.02	0.065	0.046	0.038	0.034	<0.02	<0.02
Nickel	(mg/l) N	<0.02	<0.02	0.134	0.141	0.132	<0.02	<0.02
Lead	(mg/l) N	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Mercury	(mg/l) N	0.0002	0.0003	0.0003	0.0002	0.0003	<0.0001	<0.0001
Selenium	(mg/l) N	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	(mg/l) N	0.092	0.265	0.361	0.406	0.462	0.066	0.152
pH	(value) N	7.1	5.1	3.4	3.4	11.5	7.0	7.2
Sulphate	(mg/l) N	561	526	1265	1455	1528	141	1264
Total Cyanide	(mg/l) N	0.163	0.125	1.000	1.050	1.700	0.050	0.075
Free Cyanide	(mg/l) N	0.025	0.020	0.075	0.090	0.085	<0.005	<0.005
Sulphide	(mg/l) N	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total PAH	(mg/l) N	0.071	0.042	0.019	0.002	0.010	0.015	0.011
Thiocyanate	(mg/l) N	2.1	0.2	21.5	23.5	30.0	<0.1	<0.1
Catechol	(mg/l) N	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Resorcinol	(mg/l) N	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cresols	(mg/l) N	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Xylenes & Ethylphenols	(mg/l) N	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Naphthols	(mg/l) N	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Phenol	(mg/l) N	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Trimethylphenol	(mg/l) N	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Total Phenols	(mg/l) N	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ammonical Nitrogen	(mg/l) N	0.08	4.60	22.00	30.00	35.00	13.6000	36.00
COD	(mg/l)	9	9	111	79	79	150	10
BOD	(mg/l)	<2	<2	<2	<2	<2	<2	<2

Methods of analysis & performance data available on request (V10)
N = NAMAS accredited test
Other tests not accredited

www.environmentalanalysis.com

Environmental Analysis Ltd. Registered in England no. 2059445. Reg. Office 13 Station Road London N2 2SD.
Directors: C.P.V. Knight BSc. E. L. L. Knight BSc. E. L. L. Knight BSc. E. L. L. Knight BSc. E. L. L. Knight BSc.

Your Order No: 22611
Your Job No: 3146
Reporting Date: 23/01/01



Drawing Number

201442/002

Notes

Legend

- Boreholes
- Trial Pits

Do not scale this drawing

Rev	Date	Checked

Client	Monkton Coke & Chemical Company
Project	Monkton Gas Purification Plant
Title	Site Investigation Exploratory Hole Locations

Drawing No.	201442/002			
Scale	1:500	Date	22.01.01	
	Drawn S.H.	Checked		Approved

Copyright reserved
Babtie Group Ltd Fairbairn House,
Ashton Lane, Sale
Manchester, M33 6WP