AMBER VALLEY
BOROUGH COUNCIL

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Environmental Protection Act 1990, Part IIA – Section 78B
Defra Circular 01/2006 Paragraph B.52.

Record of Determination of Cinderhill (Acid Tar Pits), Kilburn, Derbyshire as Contaminated Land.

1.0 Introduction

In accordance with the *Environmental Protection Act 1990: Part IIA* and the Statutory Guidance contained in *Circular 01/2006*, Amber Valley Borough Council have identified Contaminated Land at:

Cinderhill, Kilburn, Derbyshire (see Schedule 1, Figure 1) - national grid reference for the centre of the site, approximately, SK 377470 (x437680, y34700).

The map has been attached to clearly identify the area of Contaminated Land subject to this Determination (B.35 Statutory Guidance, Circular 01/2006). AVBC have defined the extent of the land with due consideration to the requirements of B.32 – B.36 the Statutory Guidance, Circular 01/2006.

This document is the written record of the Determination that Amber Valley Borough Council is required to prepare by paragraph B.52 of Statutory Guidance, Circular 01/2006.

Current Site description

The land forms a roughly rectangular parcel of land, approximately 11.5 hectares in size and which lies east of the A38, in Kilburn Derbyshire. The land that has been Determined as Contaminated Land forms a part of a larger site whose history is detailed below. Schedule 2, Figures 2 & 3 are an approximation of the proportion of the original site that has been subject to Detailed Investigation.

Part of the eastern boundary of the site is marked by a small stream. To the north of the site are open fields in use for crops and grazing. To the south of the site are fields and residential housing. The majority of the site to the east of the trunk road has a very uneven topography, but overall there is a fall from west to east. Surface water features on the site include 'southern', 'middle' and 'northern' lagoons and a number of smaller ponds. There are 5 known acid tar pits on the site, and a quantity of other wastes.

Site history

Permission for "*winning and working clay and some coal by surface methods*" was granted to Frank Hayes Limited in 1961 for a period of 5 years. In 1966 Mr G S Langton applied to extend the period of working until 1975, and again in 1976 extended to 1980.

Dalton & Company Limited was granted permission for the "*tipping of tar waste and ash*" at Cinderhill until 1975. Fuller's earth was to be tipped with the tar wastes to assist in the solidification of the wastes. Dalton applied to extend the area in use for tipping in 1974, with permission granted in 1975; the permission included a condition for the placement of 300mm of topsoil on the finished surface.

Derbyshire County Council granted a Waste Disposal Licence (licence number LK03 to the operation in 1978, to deposit used filter material, acid tar and ash. Severn Trent Water also granted consent to discharge site drainage to the adjacent stream, consent number WQ/7/416.

The construction of the A38, in 1976, effectively cut the site into two parts. Leaving approximately 8 tar pits on the western side, and 5 on the eastern side. Stability issues and seepage from the pits on the western side resulted in the Department of Transport

contracting Leigh Analytical Services Limited to remediate the tar pits on the western side. The material was excavated for off site disposal, some material was deposited on the eastern side of the site in Tar Pit IA. The pits were back-filled with granulated quicklime and materials won from the road cutting.

Despite further applications to extend the disposal periods, DCC restricted the disposal operation to the tipping of Fullers earth and ash until 1981.

In 1980 & 1981 Mr G S Langton made further application for the winning of clay and coal at the site, these applications were refused.

Between the end of the disposal operations and 1985 unauthorised excavations in the vicinity of the middle lagoon, caused acid tar to contaminate that lagoon.

2.0 A Description of the Particular Significant Pollutant Linkages (B.52(a)).

The Significant Pollutant Linkages, that form the basis of this Determination, are presented in Table 1, below.

Table 1. Description of the Particular Significant Pollutant Linkages.

The Significant Pollutant linkages (Relevant Section of *Statutory Guidance*)					
Significant Pollutant Linkage No.	Contaminant (A.12)	Pollutant (A.17)	**Significant Pollutant** (A.20)	**Pathway** (A.14b)	**Receptor** (A.13a)
1	Total Petroleum Hydrocarbon Aliphatic Range C_{16} to C_{35}	A relationship exists between the Contaminant, Pathway and Receptor, therefore a Pollutant Linkage exists.	This Pollutant is a Significant Pollutant as it forms part of a Significant Pollutant Linkage as it will form the basis for the Determination of the land as Contaminated Land.	The Significant Pollutant is a component of the Acid Tar Leachate, present in areas on the surface of the land, therefore there is a Dermal Pathway to the Receptor.	The Receptor is Human Beings, that have access to the land, and the Receptor could be harmed by the contaminant.
2	Total Petroleum Hydrocarbon Aromatic Range C_{21} to C_{35}	A relationship exists between the Contaminant, Pathway and Receptor, therefore a Pollutant Linkage exists.	This Pollutant is a Significant Pollutant as it forms part of a Significant Pollutant Linkage as it will form the basis for the Determination of the land as Contaminated Land.	The Significant Pollutant is a component of the Acid Tar, present in areas on the surface of the land, therefore there is a Ingestion Pathway to the Receptor.	The Receptor is Human Beings, that have access to the land, and the Receptor could be harmed by the contaminant.

3	Benzo(a) pyrene	A relationship exists between the Contaminant, Pathway and Receptor, therefore a Pollutant Linkage exists.	This Pollutant is a Significant Pollutant as it forms part of a Significant Pollutant Linkage as it will form the basis for the Determination of the land as Contaminated Land.	The Significant Pollutant is a component of the Acid Tar, present in areas on the surface of the land, therefore there is a Ingestion Pathway to the Receptor.	The Receptor is Human Beings, that have access to the land, and the Receptor could be harmed by the contaminant.
4	Benzo(a) pyrene	A relationship exists between the Contaminant, Pathway and Receptor, therefore a Pollutant Linkage exists.	This Pollutant is a Significant Pollutant as it forms part of a Significant Pollutant Linkage as it will form the basis for the Determination of the land as Contaminated Land.	The Significant Pollutant is a component of the Acid Tar, present in areas on the surface of the land, therefore there is a Dermal Pathway to the Receptor.	The Receptor is Human Beings, that have access to the land, and the Receptor could be harmed by the contaminant.
5	Sulphuric Acid (H_2SO_4)	A relationship exists between the Contaminant, Pathway and Receptor, therefore a Pollutant Linkage exists.	This Pollutant is a Significant Pollutant as it forms part of a Significant Pollutant Linkage as it will form the basis for the Determination of the land as Contaminated Land.	The Significant Pollutant is a component of the Acid Tar flows present in areas on the surface of the land, therefore there is a Dermal Pathway to the Receptor.	The Receptor is Human Beings, that have access to the land, and the Receptor could be harmed by the contaminant.

Summary of the Significant Pollutant Linkages.

1. Aliphatic Hydrocarbon Range C_{16} to C_{35} is a threshold toxic agent that has been identified in the Leachate that occurs with the acid tar flows on the sites surface. The Pollutant has been modelled to show a theoretical long-term risk to a male child (age 6-16 years) via dermal contact. The Human Health Effects that would be presented by this theoretical risk may include hepatoxicity and nephrotoxicity (damage to liver and kidneys) effects.

2. Aromatic Hydrocarbon Range C_{21} to C_{35} is a threshold toxic agent that has been identified in the leachate that occurs with the acid tar flows on the sites surface. The Pollutant has been modelled to show a theoretical long-term risk to a female child (age 6-16 years) via ingestion. The Human Health Effects that would be presented by this theoretical risk may include hepatoxicity and nephrotoxicity (damage to liver and kidneys) effects.

3. Benzo(a)pyrene is a non-threshold toxic agent that has been identified in the soil/tar that occurs with the acid tar flows on the sites surface. The Pollutant has been

modelled to show a theoretical long-term risk to a male child (age 6-16 years) via ingestion. The Human Health Effects that would be presented by this theoretical risk may include carcinogenicity (ability to cause cancers), genotoxicity (ability to lead to chromosomal damage ie. mutations) and non-tumour toxic effects.

4. Benzo(a)pyrene is a non-threshold toxic agent that has been identified in the leachate that occurs with the acid tar flows on the sites surface. The Pollutant has been modelled to show a theoretical long-term risk to a female child (age 6-16 years) via dermal contact. The Human Health Effects that would be presented by this theoretical risk may include carcinogenicity (ability to cause cancers), genotoxicity (ability to lead to chromosomal damage ie. mutations) and non-tumour toxic effects.

5. Sulphuric Acid (H_2SO_4) is a corrosive threshold toxic agent that has been identified in the acid tar flows on the sites surface. There are no protocols for assessing the probability of the Significant Harm that is posed by this Pollutant, however based on a literature review (see Section 3.0, Summary of Report 6) it is considered that the corrosive nature of the material, and the concentrations found during the Detailed Inspection, makes it capable of causing Significant Harm which could be irreversible or incapable of being treated, would result from a single exposure and could result from a short-term exposure (less then 24 hours). The most likely receptor is considered to be a male child (age 6-16 years) as this is the most likely category of Human Beings likely to cause agitation and splashing of the acid tar/leachate.

3.0 A Summary of the Evidence upon which the Determination is based (B.52(b)).

1. **Derbyshire County Council, Cinderhill Tar Pits Reclamation, Volume 1. Scott Wilson Kirkpatrick. October 1994.**

2. **Derbyshire County Council, Cinderhill Tar Pits Reclamation NR Belper, Derbyshire. Report on Ground Investigation, Volume 1; Factual Report. Wimpey Environmental Ltd. July 1994.**

3. **Derbyshire County Council, Cinderhill Tar Pits Reclamation NR Belper, Derbyshire. Report on Ground Investigation, Volume 2; Report Appendices. Wimpey Environmental Ltd. July 1994.**

4. **Derbyshire County Council, Technical Report WN/94/1C, Cinderhill Tar Pits, Geophysical Survey and Interpretation. British Geological Survey. October 1994.**

5. **The Banks Group. Cinderhill Site Investigation, Proposed Mixed Use Development, Volume 4. June 2006.**

6. **Amber Valley Borough Council. Cinderhill Tar Pits, Inspection Under Part IIA Of The Environmental Protection Act 1990, Evaluation of Potential Pollutant Linkages and Human Health Risk Assessment. WS Atkins. January 2007.**

Summary of Reports 1, 2, 3, 4

The reports effectively form one investigation. Derbyshire County Council (DCC), funded by English Partnerships, commissioned the investigations to identify the nature and extent of ground contamination at Cinderhill Tar Pits, this consisted of:

- Defining the area and volume of the pits,
- Defining the extent to which they have contaminated the surrounding soils and groundwater,
- Assessing the potential for migration of contamination off-site,
- Recommending alternatives for remediation of soil and groundwater.

DCC commissioned Aspinwall & Company and a team of associated consultants to carry out the investigations. Scott Wilson Kirkpatrick (SWK) were employed to monitor the site investigation and assist in interpretation. Camp Dresser & McKee (CDM) assisted in reviewing relevant remediation options, whilst Wimpey Environmental Limited (WEL) undertook the site investigation, and the British Geological Survey carried out a geophysical survey. Numerous sub-contractors were used by the appointed consultants, but the responsibility for preparing the works was largely attributable to those consultants discussed above.

The field works took place between January 10th and February 18th 1994, and was comprised of:

- Topographical survey
- Geophysical survey
- 44 no static cone penetration tests
- 13 no cable percussive boreholes
- 34 no rotary drill-holes
- 72 no machine dug trial pits/trenches
- 1 no over-water borehole
- 6 no over-water dynamic cone penetration tests

The fieldworks were undertaken in accordance with BS 5930, with climatic conditions being typically cold/mild with intermittent rain/snow. Drilling and sampling methodology followed the principles of DD175, with variations in sampling location distances to account of bedrock at surface.

The solid geology of the site was found to be coal measures consisting of inter-bedded sandstones, siltstones, ironstones, mudstones and coal seams, with an approximate 15^{o} strata incline to the east.

The hydrogeological regime within the site was found to be complex due to the discontinuous nature of the coal measures; as such the hydrogeology at the site could not be fully resolved.

Generally the shallow groundwater flow was found to be east, south–east direction. Deeper ground waters were found to experience strong vertical heads, reasoned to be due to the regional pumping of mine workings waters.

The investigations found a number of different types of made ground at the site, due to the random tipping across the site, the material types are found in combinations, pockets, lenses and bands. Table 2 is a summary of the types of made ground are, found by the investigations for Reports 1-4.

Table 2. Types of Made ground Described in Reports 1-4.

Type of Made Ground	Description	Approx. Volume of Fill Type with Contamination (m^3)
Type 1	Free Tar Product – surface flows of tar, consisting of stiff/firm black silty tar, appearance and behaviour dependant on ambient air temperature. The material exhibits many of the characteristics of lavas or glaciers. The flows arise from vertical pipe like structures from the buried tar deposit. One example was seen to have arisen through silty clays. The pipes were also associated with horizontal sheets of tar within the ground, these were found to be laterally extensive, one example stretching 40m from the source.	<800
Type 2	Foundry Sands – various descriptions of foundry sand were encountered. The sands were often found in combination with other types of waste materials.	1,800 – 2,700
Type 3	Mining/Quarry Spoil – grey /grey-brown silty clay, with little to much gravel and cobble fragments of silty mudstones, siltstone, shale etc. This material was abundant on site and appears to have bee used as a bunding or lining material.	13,100 – 26,600
Type 4	Ash and Clinker Gravels – typically dark brown friable, sandy-silty clays with bricks, cobbles and fine to coarse gravel sized fragments of ash and clinker.	8,300 – 11,400
Type 5	Natural Superficial Materials – only encountered around the margins of the site. Soft to hard grey silty clay with some to many angular fine to coarse gravel and cobble sized fragments of grey mudstone.	Material not contaminated.
Type 6a	Fuller's Earth – soft to firm black/grey-green/brown/light brown clay/ silty clay, found in excess of 4m in depth, at places. The material was found to be saturated with oil in places, including voids filled with oil. High acid soluble sulphate content with high cyclohexane extractable content.	11,600 – 14,900
Type 6b	Free Oil – found in voids within fuller's earth. Saturated hydrocarbons mainly C16 to C23 range hydrocarbons.	
Type 7	Tarry Silts – firm to stiff, occasionally crumbly/friable, black silty/clayey tars with a few to abundant sand-sized tar fragments. The deposits were often found as a homogenous black silt similar to surface tar flows, strong acidic odour. Consisting of up to 86% saturated hydrocarbons, 7% polar resins and 7% aromatics.	7,600 – 20,700
Type 8	Topsoils – natural topsoils were described as black-brown peaty clay and brown silty clay. Found to be contaminated by leachate from the tar pits and surface tar flows.	100 – 2,700
Type 9	General Fill Materials – mixture of clays with gravel and cobbles of brick and sandstone, coal, ash and other miscellaneous items.	3,300 – 5,800
Type 10	Compacted Soils – various compacted granular materials.	c.200
Type 11	Compacted Gravels – compacted gravel sized fragments of sandstone, mudstone and siltstone. These are possibly the old stockpiles from the active site, or former haul roads.	900 – 1,700
Natural Ground	Natural Bedrock contaminated with type C2 contamination.	3,500

Total	**52100 - 91000**

Estimates of the volumes and depths of the tar pits were obtained from the BGS Geophysical Survey (Report 4), when interpreted considering the borehole logs of the main investigation (Reports 1-3), these are presented in Table 3 below.

Table 3. The Estimated Volumes and Fill of the Tar Pits.

Tar Pit	Details		
Tar Pit 1	Estimated Volume of Fill		17,800 m^3
	Estimated Volume of Underlying Contaminated Rock		5,000 m^3
	Maximum Depth of Pit		15.7m
	Approximate Composition		
		Type 2	10-15%
		Type 3	15-40%
		Type 4	10-15%
		Type 6	5-10%
		Type 7	5-25%
		Type 8	<5%
		Type 9	5-10%
		Type C2	15%
Tar Pit 2	Estimated Volume of Fill		12,800 m^3
	Estimated Volume of Underlying Contaminated Rock		4,000 m^3
	Maximum Depth of Pit		13.2
	Approximate Composition		
		Type 3	20-35%
		Type 4	20-25%
		Type 7	20-25%
		Type 6, 8, 9, 11	20-25%
Tar Pit 3	Estimated Volume of Fill		16,000 m^3
	Estimated Volume of Underlying Contaminated Rock		7,000 m^3
	Maximum Depth of Pit		11.5m
	Approximate Composition		
		Type 1	<5%
		Type 3	30-70%
		Type 4	<10%
		Type 6	<10%
		Type 7	5-10%
		Type 8	<5%
		Type 9	5-15%
		Type 11	<5%
		Type C2	5%
Tar Pit 4 North	Estimated Volume of Fill		3,300 m^3
	Estimated Volume of Underlying Contaminated Rock		1,700 m^3
	Maximum Depth of Pit		11m
	Approximate Composition		
		Type 3	5%
		Type 4	25%
		Type 6	25%
		Type 7	>25%

		Type 8	5%
		Type 9	15%
Tar Pit 4 South	Estimated Volume of Fill		9,000 m^3
	Estimated Volume of Underlying Contaminated Rock		3,000 m^3
	Maximum Depth of Pit		11m
	Approximate Composition		
		Type 4	30%
		Type 6	60%
		Type 3, 9, 10, 11	10%
Tar Pit 1A	Estimated Volume of Fill		2,900m^3
	Estimated Volume of Underlying Contaminated Rock		0 m^3
	Maximum Depth of Pit		8m
	Approximate Composition		
		Type 4(oily)	15%
		Type 6	70%
		Type 3, 8, 9	15%

Summary of The Evidence Provided by Reports 1-4.

The investigations do not meet the requirements of B.39 of the statutory guidance; however the information they contain is appropriate to contribute to the requirements under B.20 (a) of the statutory guidance.

Summary of Report 5.

This report contains information in support of a planning application, which includes the area of subject site but principally relates to the wider area for which development is proposed. There are no proposals to redevelop the subject site, but it is stated that the subject site will be remediated as part of the proposed development works by use of a capping and landscaping scheme. The principal documentary sources in Report 5 are Reports 1-4. However, as part of the works, additional site investigation was undertaken on land adjacent to the subject site. These additional works comprised the excavation of six trial pits on site, five trial pits off-site to the east and the drilling of six boreholes to the east of the site, these works took place between 2002 – 2006.

The report offers confirmation of the findings of Reports 1–4. The Report also specifies a suggested timescale for voluntary Remediation of the Site to commence in 2009. However this is dependant on the application receiving planning permission and the site potentially undergoing compulsory purchase, before it can be fully investigated and assessed for appropriate remediation proposals to be drawn up.

Summary of Report 6.

This report was undertaken based on a site visit on 21st November 2006, by Environmental Scientists from Atkins and the Scientific Officer from AVBC. The inspection was undertaken to provide information to fulfil the requirements of B.20(b) of the Statutory Guidance, and allow AVBC to gather evidence upon which to base a Determination.

Although AVBC believed the land to fit the definition of a Special Site, the Environment Agency were unable to undertake a Detailed Inspection of the land, therefore AVBC undertook this Detailed Inspection; this is discussed further in Section 4.0.

The inspection was undertaken in order to obtain a greater understanding of the site conditions, confirm that the condition of the site's surface was consistent with that described in Reports 1–5, and to facilitate the collection of: 10 shallow/surface soil samples; 2 tar/leachate samples; and, 4 surface water samples.

The samples were analysed for

- petroleum hydrocarbons by carbon range and aliphatic /aromatic split in accordance with the TPHCWG which has recently been adopted by the Environment Agency. This includes 13 carbon bands and BTEX compounds,
- speciated poly-aromatic compounds (PAHs),
- pH, acidity and sulphate,
- a forensic examination of one representative tar sample.

The site was theoretically split into 4 zones, for the purposes of describing the site.

Rock Slope (approximately 20% of the sites surface area).
A rock slope forms much of the western boundary of the site. This was inspected and there was no visible evidence of any hydrocarbon contamination

Grassed or wooded areas (approximately 40% of the sites surface area).
These are Grassed or wooded areas with no visible signs of contamination or tar bleed. A total of 100 shallow hand augers were undertaken around the site to a typical depth of 0.5mbgl. There was no visual evidence of acid tar in the soil arisings, or any evidence of vegetation die back. The ground appeared to be reworked natural ground such as silty clay and soils.

Tar Pits (approximately 20% of the sites surface area).
These are exposed tar pits and localised areas of tar bleed. The tar liquor on site was found to contain dissolved TPH fractions (including BTEX), and was acidic (noted both as pH, acidity and total sulphate, all indicators of the presence of Sulphuric Acid).

A forensic examination of one representative tar sample from Tar Pit 4 was undertaken. The examination concluded that the product is derived from petroleum hydrocarbon sources. The product is predominantly aliphatic (straight chains), which is consistent with the chemical testing and the site history. Asphaltenes content (C35+) of 83% was recorded and the tar was found to contain lesser concentrations of PAH and BTEX compounds.

Tar pits 1 and 2 are characterised by a cover of undulating black gravely earth. The locality is used for unofficial motocross activities; there are ramps and tracks in the soil profile. There is sparse vegetation over the pits and there are a number of localised black coagulated tar bleeds discharging immediately outside of the pit area. The tar bleed and surface material, when disturbed, released thick black liquor, which was sampled and submitted for chemical analysis. The liquor had a very sharp acidic odour.

Approximately half of Tar Pit 3 is characterised at the surface by a mixture of black gravely sand and coagulated black dense tar bleed. This area is sparsely vegetated and the surrounding soils have suffered significant vegetation die back. The remainder of the area occupied by the tar pit is vegetated but there are a large number of isolated black tar bleeds located throughout the area.

Tar Pit 4 is partially vegetated and approximately a third of the surface area is characterised by a cover of black sandy gravel, which overlies solid brittle tar deposits. The tar is solid enough to walk over. There were burnt-out cars visibly submerged in the wastes. It appeared that they have been set alight and have subsequently sunk in the melted tar. This was considered potential evidence of the activities of children on the site. The tar is being displaced down a steep embankment on the eastern pit boundary. Water, discoloured and with a sharp odour, was standing in puddles in the tar pits and within the tar bleed. Upon excavation with the hand auger, the void filled with black and silty standing water. This water was sampled and submitted for chemical analysis.

Tar Pit 1a is water logged and partially vegetated, but the vegetation has died back in part of the pit. The standing water is oily with a brown scum floating on the surface. A number of hand augers were undertaken and identified that the acid tar is very wet and mobile in this location and is intermixed with clay deposits.

Water (approximately 20% of the surface area).
There are three water filled lagoons on site, and an adjacent brook (not counting numerous ponds in apparently uncontaminated areas of site. Dissolved phase petroleum hydrocarbons (including BTEX compounds) were not identified in the adjacent brook, the middle or southern lagoons; this is consistent with the findings of the previous site investigations.

Naphthalene and phenanthrene were detected at very low concentrations (ng/l) in the middle and southern lagoons. These PAHs were also recorded in the surface water samples collected from the brook, along with a number of other PAH compounds, which were not detected in the lagoon waters, but are present in the tar wastes.

Such PAH compounds are present in coal deposits in coal measure areas, and can readily leach into the aqueous environment. It is plausible therefore that they are natural background concentrations.

Concentration and indicators of sulphuric acid were identified in the middle lagoon greater than the applicable EQS standards. The water quality in the southern lagoon and adjacent brook are comparable and the concentrations do not exceed EQS standards. Again this is consistent with the findings of the previous site investigations.

Off-Site Inspection
The full length of the tributary of the brook on the eastern boundary of the site was inspected for any visible signs of acid tar contamination. No indication of any such contamination was recorded. The water appeared to be uncontaminated from any discharges from the site. There were no signs of the migration of any contamination noted in the field drain, which flows in an easterly direction on the southern boundary of the site. There was no visual evidence of any contamination migrating off-site to the adjacent fields at the eastern and southern boundary of the site.

The report went on to consider the earlier reports and undertake a Detailed Human Health Risk Assessment based on the findings of the inspection.

Long-Term Risk.
Long-term risk was assessed by modeling using RSIC Workbench, adapted to apply the requirements of CLR9, CLR10 and CLEA Briefing Notes 1 to 4.

The human receptors chosen for the assessment were:

- The first key receptor was a male in the (6-16) age group who enters the site over a ten year period. Initial exposure scenarios have been set at two hours a day, seven days a week over a week year. This scenario also considers the receptor will ingest a minimal amount of surface water, given the recreational activities on site.

- The second receptor was a female (6-16) who will visit the site for a maximum 2 hours per day, seven days a week for a year. It was assumed that this receptor is less likely to undertake such extreme activities and is less likely to come into contact with surface tar leachate.

- The third key receptor is a male adult (16-59) who walks a dog on site every day for one hour a day, over a period of one year. It was assumed that this receptor would not come into contact with surface tar leachate.

The assessment found no theoretical unacceptable long-term risks to the health of the adult dog walker receptor.

Marginal theoretical risks were found to the female child, as a result of soil ingestion and dermal contact with Total Petroleum Hydrocarbon Aromatic Range C_{21} to C_{35} and Benzo(a)pyrene respectively.

Marginal theoretical risks were found to the male child, as a result of soils ingestion of Total Petroleum Hydrocarbon Aromatic Range C_{21} to C_{35} and Benzo(a)pyrene. The greatest risk was found from dermal contact with Total Petroleum Hydrocarbon Aliphatic Range C_{16} to C_{35}.

No risks were found from slightly contaminated surface water features.

In accordance with CLR9 the threshold contaminants (the TPH fractions) were considered as mixtures based on identical exposure routes.

By this method, the adult dog walker was at a marginal theoretical risk from the TPH contamination. Due to the very marginal nature of the results it was not considered appropriate to consider this issue as a Significant Pollutant Linkage.

Both the child receptors were found to have increased risks when subject to the CLR9 mixture consideration.

Short-Term Risk.
Sulphuric acid concentrations were recorded between 0.3% and 6.6% by mass, in those areas affected by tar bleed at the surface of the site. The most likely exposure route associated with the sulphuric acid, relates to dermal or ingestion of acids within the tar bleeds, black gravely sand or tar liquor.

There are no protocols for assessing the likelihood of such an exposure event occurring and it is noted that the range of sulphuric acid concentration varies significantly throughout the site.

However the child receptors are likely to be at risk of either acid burns to the skin or eyes as a result of deliberately agitating tar product and behaviour that may generate splashing in the tar liquor. Such activities may include deliberately starting fires, as observed by the

burnt-out cars, misbehaving whilst consuming alcohol (empty drink cans were observed onsite), or motorcycling in the tar wastes (as indicated by the on site trails).

A literature review was undertaken of data relevant to sulphuric acid. The following documents have been consulted:

- Croners Substances Hazardous to the Environment, 2002
- Agency for Toxic Substances and Disease Registry (ATSDR).
- Approved Supply List, 8th Edition. Information approved for classification and Labelling of Substance and Preparation Dangerous for Supply, The Health and Safety Commission, UK, 2005.
- The Environment Agency Hazardous Waste – Interpretation and definition of Hazardous Wastes (2nd Edition, Version 7.1) October 2006.

There are no protocols for assessing the probability of the significant harm that is posed by this pollutant; however, based on the literature review it is considered that corrosive nature of the material makes it capable of causing significant harm which could be irreversible or incapable of being treated. This would result from a single exposure and could result from a short-term exposure (less then 24 hours). The most likely receptor is considered to be a male child (age 6-16 years) as this is the most likely category of Human Beings likely to cause agitation and splashing of the Acid Tar/Leachate.

It is therefore considered appropriate to consider sulphuric acid as a component of a Significant Pollutant Linkage.

4.0 A Summary of the Relevant Assessment of the Evidence (B.52(c)).

The land (see Figure 1 Schedule 1) has been used for extraction and tipping purposes between 1961 and 1980. Waste acid tar that was tipped at the site during this period has found on the sites surface in increasing volumes.

AVBC commenced Detailed Inspection of the land in 2006; after informing the Environment Agency that it believed land to fit the description of a Special Site, should the land first be Determined as Contaminated Land. AVBC were informed by the Environment Agency that they would not be able to carry out Detailed Inspection of the land on behalf of the Council, at the current time.

Due to the nature of the land, and the potential risks the land poses to human health and the environment, AVBC decided to progress the Detailed Inspections itself, as it is not precluded from doing so by any part of the relevant Act, Regulations or Statutory Guidance. AVBC's decision to undertake the Detailed Inspection was communicated to the Environment Agency.

From the contaminants that the assessment considered, Total Petroleum Hydrocarbon Aromatic Range C_{21} to C_{35}, Total Petroleum Hydrocarbon Aliphatic Range C_{16} to C_{35}, Benzo(a)pyrene and Sulphuric Acid were found to pose a Significant Possibility of Significant Harm (Human Health Effect). These Significant Pollutants are present in, on and under the site in the Acid Tar. The assessment only considered the component of the Acid Tar that is on the site surface, and the risk it poses to Human Beings who have unhindered access to the site.

Based on the information contained within Reports 1-6 AVBC gave thought to the requirements of A.28 and A.29 of the Statutory Guidance in considering the timescales that

receptors may be exposed to contaminants at the site. The assessment of the Significant Pollutant Linkages detailed in Table 1 gave unacceptable hazard quotients for 10-year exposures (children age 6-16) and short-term exposures (Sulphuric Acid). AVBC believe these Significant Pollutant Linkages have been assessed correctly in light of the potential for remediation via the planning process, and that the risks posed are sufficient to judge the planning process to offer inappropriate timescales for the remediation of the land.

Long-Term Risk
The results of the assessment shows the there is a Significant Possibility of Significant Harm (Human Health Effect) from Total Petroleum Hydrocarbon Aromatic Range C_{21} to C_{35}, Total Petroleum Hydrocarbon Aliphatic Range C_{16} to C_{35}, and Benzo(a)pyrene to Human Being Receptors.

Short-Term Risk
The report also shows a Significant Possibility of Significant Harm (Human Health Effect) from Sulphuric Acid to Human Being Receptors.

5.0 A Summary of the way in which AVBC considers that the requirements of the guidance in Chapter A and Part 4 of Chapter B of the Statutory Guidance have been satisfied (B.52(d)).

Requirements of Chapter A of the Statutory Guidance, Circular 01/2006.

A.11 – Applying the definition – Step 1.
AVBC have identified Contaminants (as Pollutants), Pathways and Receptors (as detailed in Sections 2.0 & 3.0 above).

A.17 – Pollutant Linkages
AVBC have identified the Contaminants (as Pollutants), Pathways and Receptors to form Pollutant Linkages, as there are relationships between the components (as detailed in Section 2.0 & 3.0 above).

A.18 – Similar Substances
As detailed in Section 2.0 & 3.0 above, AVBC have treated the substances in the Total Petroleum Hydrocarbon Aliphatic Range C_{16} to C_{35} as being a single substance, as the substances have similar molecular structure and this molecular structure determines the effect that the substances may have on the receptor present in the Pollutant Linkage. This approach is also consistent with the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG), as modified and adopted by the Environment Agency (ref: Environment Agency Science Report P5-080/TR3).

AVBC have treated the substances in the Total Petroleum Hydrocarbon Aromatic Range C_{21} to C_{35} as being a single substance, as the substances have similar molecular structure and this molecular structure determines the effect that the substances may have on the receptor present in the Pollutant Linkage. This approach is also consistent with the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG), as modified and adopted by the Environment Agency (ref: Environment Agency Science Report P5-080/TR3).

A.19 – Applying the Definition – Step 2.
AVBC are satisfied that the Pollutant Linkages exist and each has been shown to present a Significant Possibility of Significant Harm to Human Beings (Human Health Effect); as detailed in Sections 2.0 & 3.0.

A.20 – Significant Pollutant Linkage.
AVBC are basing the Determination of the land as Contaminated Land on the Pollutant Linkages described in Section 2.0; therefore they are Significant Pollutant Linkages.

A.23 – Significant Harm
AVBC regard the Harm to the Human Receptor to be consistent with requirements of Table A of the Statutory Guidance (Human Health Effect) and is therefore Significant.

A.30 – Significant Possibility
AVBC consider that the requirements of Table B of the Statutory Guidance have been met and that 5 No. Significant Pollutant Linkages are presenting a Significant Possibility of Significant Harm (Human Health Effect).

Requirements of Part 4 of Chapter B of the Statutory Guidance, Circular 01/2006.

Physical extent of Land
B.35 – Map of Contaminated Land
Schedule 1 Fig 1 is a Map of the land that AVBC have Determined as Contaminated Land.

B.36 – Review Decision of Physical Extent of Contaminated Land
AVBC will remain prepared to review the physical extent of the Contaminated Land should any future information suggest it would be appropriate to do so.

Making the Determination
B.38 – Grounds for the Determination
AVBC base this Determination on the grounds that there is a Significant Possibility of Significant Harm (Human Health Effect) being caused.

B.39 – Scientific and Technical Assessment
AVBC have taken all relevant and available information into account and carried out an appropriate scientific and technical assessment of that evidence, that assessment is presented in report 6 (see Section 3.0 above).

B.44 – Determining That Significant Harm Being Caused.
AVBC have Determinand the land as Contaminated Land on the basis that it has undertaken an appropriate scientific and technical assessment of all relevant and available evidence and on the basis of that assessment is satisfied on the balance of probabilities that Significant Harm (Human Health Effect) is being caused; this process has been documented in Section 2 and 3 above.

B.45 - 49 – Determining That There is a Significant Possibility of Significant Harm Being Caused.
AVBC have Determined the land to be Contaminated Land on the basis that there is a Significant Possibility of Significant Harm (Human Health Effect) being caused, as defined in Chapter A of the Statutory Guidance.

AVBC have carried out a scientific and technical assessment of the risks arising from the pollutant linkages, according to relevant, appropriate, authorities and scientifically based guidance on such risk assessments; this has culminated in report 6 (see Section 3.0 above). The assessment shows that there is a Significant Possibility of Significant Harm

(Human Health Effect) being caused; and there are no suitable and sufficient risk management arrangements in place to prevent such harm.

B.52 – Record of the Determination That The Land is Contaminated Land.
AVBC have prepared this written record of the determination that Cinderhill Tar Pits is Contaminated Land. This record includes the following statutory requirements:

(a) a description of the particular significant pollutant linkage, identifying all three components of pollutant, pathway and receptor (Section 2.0, above);

(b) a summary of the evidence upon which the determination is based (Section 3.0, above);

(c) a summary of the relevant assessment of this evidence; and (Section 4.0, above);

(d) a summary of the way in which the authority considers that the requirements of the guidance in this Part and in Chapter A of the guidance have been satisfied (this Section).

6.0 Summary of the Record of Determination.

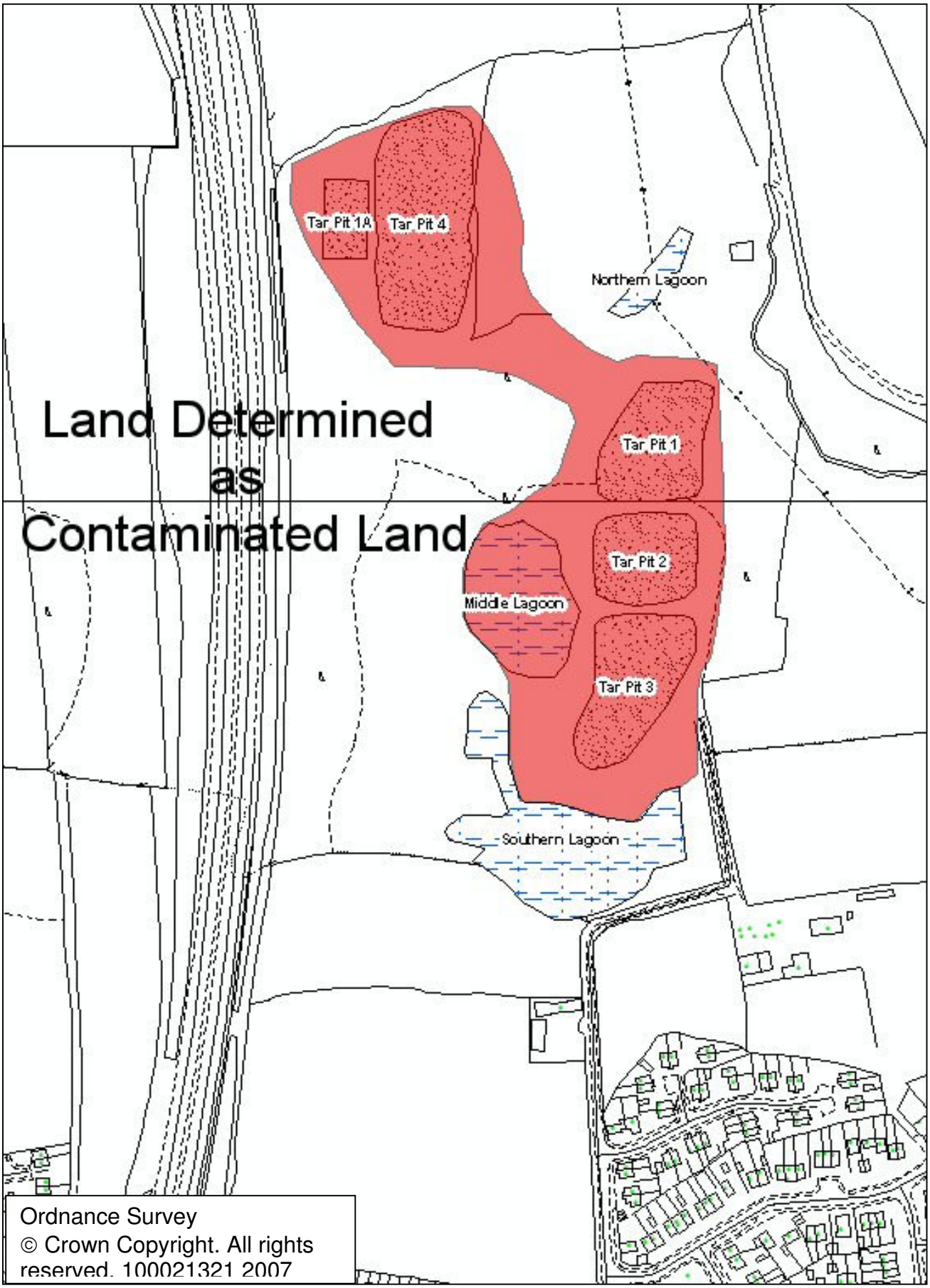
Amber Valley Borough Council makes this Determination on the grounds that Total Petroleum Hydrocarbon Aromatic Range C_{21} to C_{35}, Total Petroleum Hydrocarbon Aliphatic Range C_{16} to C_{35}, Benzo(a)pyrene and Sulphuric Acid were found to pose a Significant Possibility of Significant Harm (Human Health Effect), on Humans that have open access to the site.

Signed: _____ Date: 19th February 2007

Mr P M Carney
Chief Executive

Schedule 1

Figure 1 (included as a separate A0 plan) – Area of Land Determined as Contaminated Land.



Schedule 2

Figure 2 – Approximate Area of Historic Extraction and Waste Site.

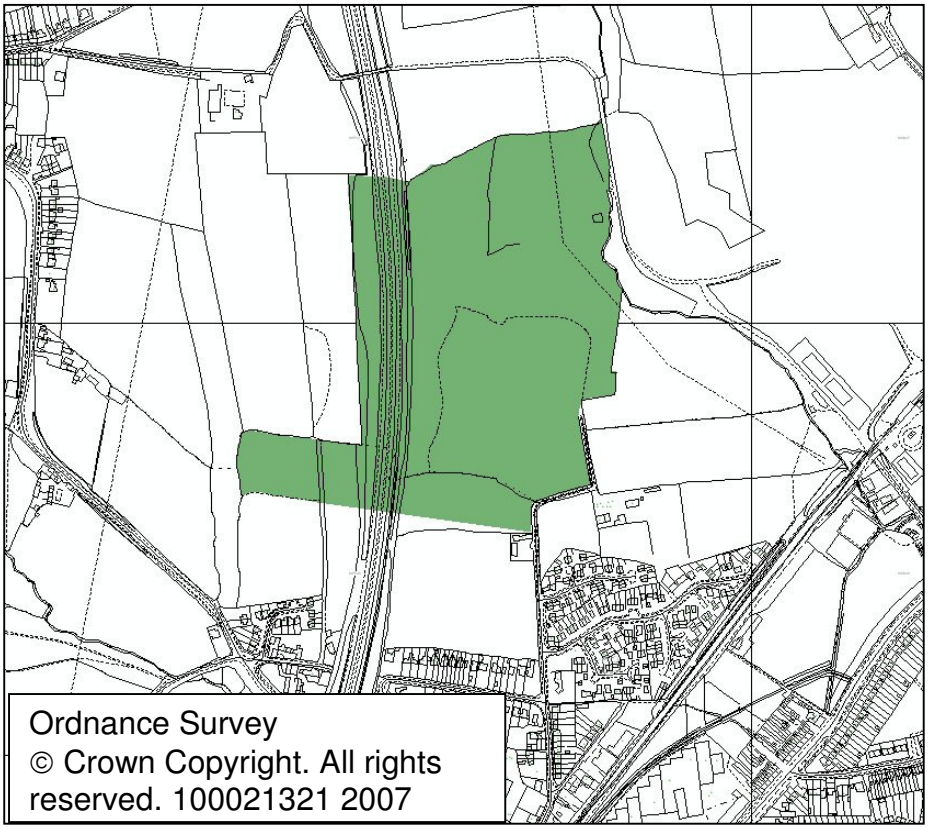


Figure 3 – Approximate Area of Site Subject to Detailed Inspection (Light Green).