

STUART GUY CONSULTING

Report number 15-08-03/2

Date 30th October 2015

Environmental Risk Assessment of site off Kirkgate

Whaplode, Spalding, Lincolnshire, PE12 6TF

Non - technical Summary

The site (about 0.19 ha) is located off Kirkgate and opposite a large industrial site that produced metal structural components for use in various industries, including construction. The area is flat and level and the site has houses on the other three boundaries.

A discharge consent relating to the site under investigation was probably authorised to allow quench water from heat treated components to be disposed of and explains how it became slightly contaminated with heavy metals. This site was also used to park cars for the industrial unit and this could lead to potential contamination from partially burned hydrocarbons arising from engine oil leaking or from sooty exhaust deposits. No other sources of potential contamination were identified near to the site that could impact on this site.

The soil under the site is largely impermeable and the nearest surface water is a ditch to the north of the site. The development plan is to construct 3 houses on the site

The site investigation reported little or no hydrocarbons or sooty deposits but some heavy metals at elevated concentrations were reported. Therefore, the soil in the gardens will have to be removed down to about 400 mm and replaced with soil of suitable quality. The risk to the aquatic environment is not significant owing to the impermeable nature of the soil under the site and the very low solubility of the metals and hydrocarbons identified.

No further site investigation is necessary.

Environmental Risk Assessment of site off Kirkgate

Whaplode, Spalding, Lincolnshire, PE12 6TF

Planning Application No. H23-0273-15

1. Scope of the Risk Assessment

1.1 Under instructions from Peter Pitt of D Brown Building Contractors Limited, Seas End, Moulton Loosegate, PE12 6JX, I have prepared this risk assessment based on the following:
A Sitecheck Data Report dated 22nd September 2015, reference SCD_72837453_1_1
A visit to the site on 23rd September 2015
Information on the site from Myles Johnson from D Brown Building Contractors about the site and the works opposite
Analysis of samples by The Environmental Laboratory Ltd, report number 15-03866, dated 30th September 2015

1.2 The purpose of this report is to assess whether this site, or potential contaminants from adjacent sites, could present a significant risk of harm to the occupiers of the site or to the environment.

2 Sitecheck Data Report + Google Satellite Image

2.1 The Sitecheck Data report searches features that are recorded on maps or in trade directories of the surrounding area and points to features that may be of concern. As with all automated systems, this tends to identify many features that are not relevant and therefore interpretation of the results is required.

2.2 The Google satellite image shows the site to be across the road from a very large industrial building with extensive outbuildings and parking facilities.

2.3 Under current land use for the site, two unknown discharge consents were granted pre national rivers authority legislation.

2.4 Under current land use for the surrounding area, there is a local authority pollution and prevention controls authorisation on the large industrial site across the road to the west, there are 14 discharge consents at many locations in the village, there is a site that has had motor cycles, garage services and furniture manufacturing, all inactive, at about 150 m to the north, an inactive fuel filling station is noted at about 160 m to the north, an inactive road haulage services is marked at about 190 m to the south, an inactive refrigeration services business is noted at about 200 m to the southeast, an inactive gun and tackle shop is marked at about 250 m to the south and an obsolete fuel station entry is marked at about m to the northeast.

2.5 Under historical land use for the site, nothing is noted.

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2.6 Under historical land use for the surrounding area, an electrical substation is noted at about 120 m to the southeast, tanks are marked at about 170 m to the south, the large industrial unit across the road is marked as a factory, a cemetery is marked at about 100 m to the south, a road haulage business is marked at about 180 m to the southwest and unknown filled ground is noted on the factory site at about 150 m to the northwest.

2.7 Groundwater vulnerability is classified as non aquifer with negligibly permeable formations and the soil leaching potential is not classified. The nearest surface water feature is a stream about 30 m to the north.

2.8 Radon above the action level affects less than 1% of homes and no radon protection measures are recommended. The site is in an area that may not be affected by coal mining.

2.9 In summary, the site is in a small village with a very large industrial unit across the road, two unknown discharge consents were authorised for the site, groundwater vulnerability is classified as non aquifer and the nearest surface water feature is a stream some 30 m from the site.

3 Site Visit on 23rd September 2015 and information from Myles Johnson

3.1 The site was visited when the weather was dry and bright, The site is surrounded on three sides by houses (photos 1 & 2). The Google map with ground level photographs shows the site to be owned at some stage by Green Structural (the name of the factory on the western side of the road opposite the site) and used as a car park.

3.2 The large industrial site on the western side of the road is the only significant source of potential contamination near to the site (photos 3 & 4). The area is very flat and the fuel filling station locations are too far away to impact on this site. Myles Johnson worked at Green Structural and he explained that they produced structural fittings for a wide variety of industries. Many of them were subject to heat treatment and it is highly likely that the car park was originally used to dispose of the quench water. This would contain small fragments of metal oxides from the steel alloys that were used and may contribute to contamination of the site. Latterly, the site was used as a car park and engine oil and sooty deposits from exhaust systems could be sources of potential contamination.

3.4 A walk around the site confirmed the Google images of only residential housing around three boundaries of the site.

4. Conceptual Model

4.1 The site (~0.19 ha) is located off Kirkgate and comprises the car park for the former metal structural production site on the opposite side of Kirkgate. The site was had a discharge consent for unknown discharges and the most likely water discharge was quench water from heat-treated components. The site was also used for some years as the car park for Green Structural, presenting the potential for oil and sooty deposits from exhausts to be deposited on the site. The development plan is to construct 3 houses on the site.

4.2 The ground is flat and level and has the deeper soil formations are classified as non aquifer

4.3 The suggested model of ‘source, pathway, target’ in which all three components have to be present will be considered for this site. In this context, the source will be a potential contaminant, the receptor will be human or environmental and the pathway will be some process whereby mass transfer from source to receptor occurs.

4.4 Possible pollutant linkages:

Contaminant	Pathway	Receptor
Hydrocarbons from leaking engine and gearbox oil (TPH)	Inhalation of dust Ingestion of dust Migration into groundwater and aquifer	Occupiers of new development Groundwater
Heavy metals from discharging quench water used in heat treatment of steel components	Inhalation of dust Ingestion of dust Migration into groundwater and aquifer	Occupiers of new development Groundwater
Polycyclic aromatic hydrocarbons (PAH) from sooty deposits in exhaust	Inhalation of dust Ingestion of dust Migration into groundwater and aquifer	Occupiers of new development Groundwater

5 Conclusions and Recommendations

5.1 The discharge of quench water is a very real possibility as the plant was operational in the 1960s when control of such deposition was very minimal. However, the usual elements used in alloy steels are not very soluble in metal oxide form, so movement into the deeper formations is very unlikely.

5.2 Parking of cars on the site could cause contamination by petroleum hydrocarbons, mainly from leaking lubricating oils, but also from petrol leaks and spills if filling had taken place from petrol containers. PAH contamination could occur from engine oil and from soot from exhaust systems as DIY repairs were sometimes carried out in car parks.

5.3 A site investigation with soil sampling is necessary to determine if heavy metals, TPH and PAH contamination has occurred on the site. The samples are to be analysed for a heavy metals, TPH and PAH.

6 Site Investigation and Trial Pit Logs

6.1 There was no evidence for any specific location of potential contamination, so four trial pits were excavated, one near each corner of the site.

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6.2 Trial Pit logs:

TP1 in southwest corner of site (Kirkgate side) (photo 5)

Depth	Description of ground
0 – 0.4 m	Soil, bricks (whole and fragments), stones and thin layer of gravel on top
0.4 – 0.95 m	Light brown silty sand with sandstone lumps
0.95 – 1.4 m	Dark brown silty clayey sand
	Samples from 0 – 0.4 m, 0.4 – 0.95 m

TP2 in southeast corner of site (photo 6)

Depth	Description of ground
0 – 0.3 m	Soil, bricks (whole and fragments), stones and thin layer of gravel on top
0.3 – 1.2 m	Dark brown silty clayey sand
	Samples from 0 – 0.3 m, 0.8 – 1.2 m

TP3 in northeast corner of site (photo 7)

Depth	Description of ground
0 – 0.2 m	Thin layer of gravel, then light brown silty sand under
0.2 – 1.0 m	Dark brown silty clayey sand
	Samples from 0 – 0.2 m, 0.6 – 1.0 m

TP4 in northwest corner of site (photo 8)

Depth	Description of ground
0 – 0.2 m	Thin limestone hardcore top with light brown silty sand under
0.2 – 1.2 m	Dark brown silty clayey sand
	Samples from 0 – 0.2 m, 0.8 – 1.2 m

6.3 The samples were placed into a cool box containing an ice pack for transport to the office. The cool box (with a new ice pack) was sent by carrier to The Environmental Laboratory Ltd where UKAS accreditation has been obtained for most of the species required.

6.4 A very crude soakaway test was performed whilst the soil samples were being collected, in that water from three barrels holding, each holding approximately 200 litres, was tipped into TP1 and left to see how fast it would soak into the ground. After 30 minutes there was still a substantial depth of water in TP1, showing that infiltration rates into the silty clayey sand were very low.

7. Analytical Results

7.1 The concentrations of heavy metals in the near surface samples were higher than those in the deeper samples. For example, zinc concentrations were elevated above those normally found in soils in all the samples, with that from the near surface layer in TP4 reporting 14,400 mg/kg and that from the deeper layer reporting 862 mg/kg. Cadmium, mercury and selenium concentrations were very low in all the samples, but these elements are not found in alloy steels. Zinc is also not an element that is found in alloy steels, zinc castings are used in

structural components and small flakes of zinc abraded from them could be the source. Arsenic is quite high in all the samples, three exceeding the soil guideline value (SGV) of 32 mg/kg for gardens in which food is grown. However, this could be naturally occurring arsenic as many sandy soils in Lincolnshire contain arsenopyrite. Lead concentrations were also elevated, but again this is not added to alloy steels, so may have originated from other types of structural fittings.

7.2 The concentrations of PAH species in the four samples were quite low, but concentrations of benzo(α)pyrene in all the near surface samples were slightly elevated (1.0, 3.5, 1.5 and 2.3 mg/kg for TP1, 2, 3 and 4 respectively).

7.3 The concentrations of petroleum hydrocarbon fractions were very low in sample from TP1, 2 and 3, but slightly elevated in TP4 (the two largest molecular mass fractions account for 208 mg/kg out of the total of 211 mg/kg).

8. Risk Assessment

8.1 The concentrations of heavy metals that were toxic to human health were not particularly high, but arsenic exceeded the SGV in three samples. However, with so many of the metals concentrations being elevated randomly and the top soil containing many bricks and fragments, removal of some of the topsoil is recommended.

8.2 The concentrations of TPH in 7 of the 8 samples were very low, with the eighth sample from the top layer of TP4 having elevated concentrations of the two highest molecular mass fractions. These TPH fractions are not very mobile and have virtually no vapour pressure. Therefore, the risk of harm to the occupiers of the site and to the environment from TPH is not significant and the risk is acceptable.

8.3 The concentrations of total PAH in the eight samples were quite low, but the four samples from the top surface had benzo(α)pyrene concentrations that were above the SGV that was calculated some years ago, but never consolidated as a published SGV by the Environment Agency. As the top layer is being removed because of the heavy metals found in it, then once this is completed, the risk of harm from PAH to the occupiers of this site and to the environment will not be significant and the risk will be acceptable.

8.4 The risk of harm to surface and groundwater is dependent on infiltration into the ground and lateral flow to surface water, as well as solubility of the contaminants reported. The metal oxides, arsenopyrite, the PAH species identified and the higher molecular mass hydrocarbon fractions are all largely insoluble. The groundwater vulnerability is classified as non aquifer and its low infiltration was demonstrated by a crude test. Therefore the risk of harm to the aquatic environment from metals, PAH and hydrocarbons is not significant and the risk is acceptable.

9. Remediation

9.1 The contamination by metals probably occurred when quench water was discharged on the site and the probability of high concentrations of some metals being in small discrete areas cannot be dismissed. TPH concentrations are of no concern as the only fractions present are in one sample and from the higher molecular mass ones. No hydrocarbons from petroleum or polycyclic aromatic hydrocarbons have any vapour pressure that could penetrate the building by vapour transfer. Therefore, only the soil in the garden areas requires excavation and replacement with soil of appropriate quality.

9.2 If the contamination (mainly arsenic and benzo(α)pyrene) were of a significant nature, then excavation down to 600 mm would be recommended. However, as the contamination is marginal and confined mainly to the top layer of soil, then excavation of soil down to 400 mm and replaced with soil of suitable quality will be sufficient in this case. The planning condition requires the site to be raised about 300 mm, so this can be taken into account when excavating the top layer of hardcore and sandy material. The rubble and hardcore should be removed from garden areas down to 600 mm below the raised ground level and replaced with soil from the mound at Seas End until the level is 300 mm below the raised ground level. Then a further 300 mm of soil from the sugar beet processing plant should be placed on top to bring the gardens up to the proposed raised ground level. The excavated material can be used on site for any area not in rear gardens.

9.3 No other site investigation or remediation is necessary to provide an acceptable level of risk to the occupiers of the site.

10. Summary

10.1 The site (about 0.19 ha) is located off Kirkgate and opposite a large industrial site that produced metal structural components for use in various industries, including construction. A discharge consent relating to the site under investigation was probably authorised to allow quench water from heat treated components to be disposed of when it became contaminated with metal oxide particles. The site was also used to park cars for the industrial unit and this could have led to potential contamination from partially burned hydrocarbons arising from engine oil leaking or from sooty exhaust deposits.

10.2 No other sources of potential contamination were identified near to the site that could impact on this site.

10.3 The site investigation reported little or no TPH or PAH (but benzo(α)pyrene concentrations were above an SGV calculated some years ago) but some heavy metals at elevated concentrations were reported. Therefore, the soil in the gardens will have to be removed down to about 400 mm and replaced with soil of suitable quality. The planning condition requires the site level to be raised by about 300 mm and this can be taken into account when the rubble and hardcore is excavated. Soil from the mound at Seas End should be applied to raise the level to 300 mm below the raised level and soil from the sugar beet processing plant applied to the top 300 mm layer. The risk to the aquatic environment is not

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significant owing to the impermeable nature of the soil under the site and the very low solubility of the metals and hydrocarbons identified.

10.4 No further site investigation is necessary.

10.5 Those workers whose main job it is to grade sites or excavate significant quantities of soil could be subject to cumulative exposure to various substances on many sites and they should wear overalls and gloves, even if the soils do not present a significant risk to the health of the workforce. For example, the presence of water contaminated with Weil's disease is a small probability and working on many sites increases the risk of infection to a worker. Localised contamination from small amounts of chemicals that could have been discarded is an unlikely event, but if heavily discoloured or highly odorous materials are encountered, then appropriate advice should be sought

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Photo 1 View of site from Kirkgate with houses to north and east



Photo 2 View of site from Kirkgate with houses to east and south



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Photo 3 Very small part of buildings on large industrial site (trees block view)



Photo 4 Large industrial site from near southern end



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Photo 5 TP1 in southwest corner of site (Kirkgate side)



Photo 6 TP2 in southeast corner of site



Photo 7 TP3 in northeast corner of site



Photo 8 TP4 in northwest corner of site (Kirkgate side)

