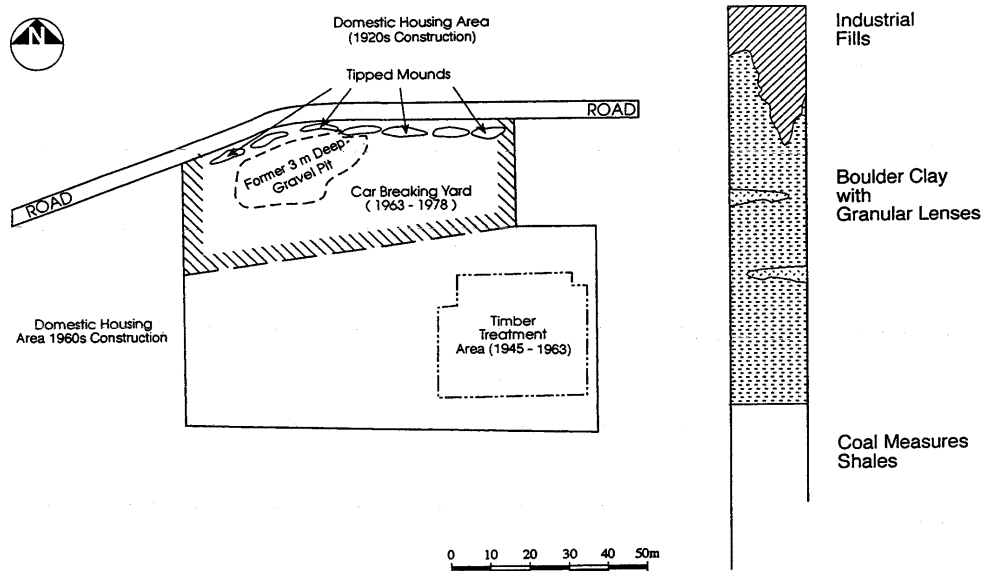


**UNIVERSITY OF PORTSMOUTH
SCHOOL OF EARTH & ENVIRONMENTAL SCIENCES**

1GS312 Contaminated Land

**Contaminated Site No. 1
Light Industrial Site-Central Scotland**

Site location and layout



Site history: Former light industrial site (0.79Ha)

Till 1920s-agricultural use.

1920s to 1945-timber storage yard occupied the entire site.

1945-a northern section of the site was utilised for the tipping of demolition rubble into a shallow (3 m deep) gravel pit.

1945 to 1963-timber treatment processes were established on south-east area of the site.

1963 to 1978-northern half of site utilised as a car-breaking yard. Southern half unused.

1978 to 1986-uncontrolled waste tipping took place over the entire site.

Site topography (pre-reclamation)

The land was essentially level and some 1.0 m higher than surrounding land. Low heaps of wastes occurred on the northern frontage with the main road. No surface watercourses exist. The closest surface water body (200 m to the north) is entirely culverted below the housing.

Natural geology

Glacial clays are recorded (up to 8 m thick) and localised lenses of gravel are known to occur within these clays. Below are Coal Measures Shales (unmined) to depths of at least 25m.

Site investigation (January 1989)

16 trial pits, at 25m spacings and to depths of 3.0m. Two boreholes, to 10.5 m depths, for foundation exploration. Chemical investigation was limited to the testing of a near surface sample of the tipped materials, exposed in each trial pit (T1). No chemical investigations were carried out on samples of the underlying glacial clays. No groundwater analyses were carried out. No landfill gas or vapour investigations were carried out.

Table I. Proven chemical contamination of the surface fills (mg/kg except for pH values)

pH	6.06 to 7.65
Sulphides (as H ₂ S)	< 1
Sulphates (2:1 water:soil extract)	253 to 2036
Toluene-extractable content	1170 to 21 120
Phenols	1.1 to 17.4
Cyanide (free)	<2
Arsenic (total)	8.1 to 34.3
Cadmium (total)	< 1 to 7.6
Chromium (total)	2.1 to 49.3
Copper (plant-available)	3.6 to 478
Lead (total)	12 to 653.2
Nickel (plant-available)	0.8 to 36
Zinc (plant-available)	2.8 to 623
Ammonium	9.2 to 39.7
Asbestos	ND

Site investigation had revealed the presence of a pervasive and thin (- 1.0 m thick except where mounds of tipped wastes occurred on the northern site frontage) capping of combustion ashes and domestic wastes. The former gravel pit was located and found to be filled with well-compacted and apparently clean demolition rubble (brick and stone debris), which appeared to have resulted from the post-war urban repair programme. Perched groundwater, as minor volumes, did occur in gravel lenses in the boulder clays. The underlying Coal Measures Shales proved to be dry to depths of 10.5 m.

Reclamation choice

The developer decided to remove all contamination concerns, by having all fills excavated and removed to an off-site tip. This choice removed the usual requirement for sub-surface gas investigations. The glacial clay surface and the top of the rubble-filled gravel pit were exposed, and house units were founded directly into the exposed surface. A sandy soil was imported to cap proposed garden areas (to 300 mm thickness). No formal quality controls were exercised, and reclamation proceeded without specialist supervision or inspection. Planned re-use Semi-detached housing and gardens. Later problems Extensive plant die-back occurred in several gardens in the south-eastern corner of the site. This forced later re-investigation (T2), which also located spilled oils and vapours in the infilled gravel pit.

Table 2. Additional contamination investigations (June 1992)

Location	Depth (m)	Results
Plot 23 (south-east corner of site) (all samples had acidities of 4.5 or less)	0.100	Plant-available copper 74 mg/kg
	0.200	Plant-available copper 136 mg/kg
	0.400	Plant-available copper 274 mg/kg (total Cr concentrations also increased markedly with depth)
North of site over infilled gravel pit	0.500	Oxygen 12%, carbon dioxide 3%
	1.000	Oxygen 2%, carbon dioxide 11 %
	1.500	Oxygen < 1 %, carbon dioxide 15 %

Reference

Carney T (1995) The Re-use of Contaminated Land – A Handbook of Risk Assessment. Wiley.