
Protection of workers and the
general public during
development of contaminated
land

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Introduction

1 Building construction and engineering works often involve redevelopment of land which has been contaminated by industrial processes once carried out on the site or by materials stored or dumped there. In some places naturally occurring contamination may be present. Contamination may be a potential health risk to those working on the site and to members of the public unless adequate precautions are taken.

2 This guidance note addresses the considerable hazards associated with contaminated land working and aspects which developers and contractors need to consider under the Control of Substances Hazardous to Health Regulations (COSHH) and the precautions to be taken during the development of the site. It does not deal with long term future use of contaminated land or advise on how the contamination should be treated. This is given in guidance notes produced by the Department of Environment's Interdepartmental Committee on the Redevelopment of Contaminated Land (ICRCL) (see Appendix 2, 1 to 7).

Assessment of risks to health

3 All those involved in work on contaminated land sites (ie surveyors, contractors, transport firms etc) will need to make an assessment of the potential risks to health entailed in the work, and the precautions required to protect workers or the public (Regulation 6 of the Control of Substances Hazardous to Health Regulations or where asbestos or lead are involved, the Control of Asbestos at Work Regulations or Control of Lead at Work Regulations). To enable them to do this, the client and the person in control of the site should ensure that sufficient information is provided on the nature, extent and level of contamination. The firms involved can then assess the risks to which they or their employees are likely to be exposed. Clearly the precautions to be taken by a lorry driver who remains in the cab will be different from those to be taken by a ground worker. However, each contractor must decide what precautions are necessary and take steps to ensure these precautions are taken. Those in control of the sites should satisfy themselves that the various contractors have carried out an assessment which is sufficient and suitable and that the specified control measures are provided and used. In most cases this assessment should be in writing. (See paragraphs 41 to 44). For further information on the COSHH Regulations see also^{18,19,25} and Appendix 2.

Industries, sites and contaminants

4 A wide range of industrial processes may give rise to contamination of land which is to be developed. An

equally wide range of contaminants may also be encountered. Some are ubiquitous and could be found on almost any site. Others, such as anthrax spores liable to be found in tannery works, are specific to the process carried out. The table taken from British Standards Institute Draft for Development DD175 1988¹¹ shows some of the industries likely to give rise to contamination and the likely contaminants to be found. However, not all sites fall neatly into different categories of contamination. Some sites can be contaminated by a range of different hazardous materials and by a mixture of concentrations and distributions, creating a 'cocktail' of noxious materials. (See Appendix 3). Contaminants may also migrate to adjacent areas via ground water.

5 Examples of naturally occurring contamination or where the industrial processes are so ancient that they are now considered to be natural, include the cadmium contamination around Shipham, a village near the Mendip Hills, outwashings of old lead mines, and in many places, geological seams of minerals. Iron pyrites are commonly present in some rocks and may produce acidic water which can react with limestone to produce carbon dioxide.

6 As a detailed example of what could be found, the following are likely contaminants associated with former gasworks^{2,8}.

- (a) oily and tarry waste deposits, especially polycyclic aromatic compounds such as naphthalene, anthracene and phenanthrene;
- (b) hydroxy aromatic compounds, eg phenol and cresols;
- (c) aromatic compounds, eg benzene, toluene, xylene and styrene;
- (d) sulphates present in soil which may be transformed microbially to sulphides which can react with acids and generate toxic hydrogen sulphide which may be released during excavation;
- (e) a number of heavy metals, metalloids and their compounds, particularly cadmium, lead and arsenic and cyanide. (It is the free cyanide which causes the main problem and this is more likely to be found at the sites of old electroplating workshops). The insoluble complex cyanides such as ferro ferri cyanide pose a lesser risk;
- (f) flammable, explosive, toxic or asphyxiant gases, methane, hydrogen cyanide, carbon monoxide, carbon dioxide, hydrogen sulphide and sulphur dioxide;

INDUSTRIES, SITES AND CONTAMINANTS

Important. This table should not be taken to mean that other types of site need not be investigated nor to mean that other contaminants are absent

<i>Industry</i>	<i>Examples of sites</i>	<i>Likely contaminants</i>
Chemicals	Acid/alkali works Dyeworks Fertilizers and pesticides Pharmaceuticals Paint works Wood treatment plants	Acids; alkalies, metals, solvents, (eg toluene, benzene), phenols, specialised organic compounds
Petrochemicals	Oil refineries Tank farms Fuel storage depots Tar distilleries	Hydrocarbons, phenols, acids, alkalies and asbestos
Metals	Iron and steel works Foundries and smelters Electroplating, anodizing and galvanizing works Engineering works Shipbuilding/shipbreaking Scrap reduction plants	Metals, especially Fe, Cu, Ni, Cr, Zn, Cd and Pb, asbestos
Energy	Gasworks Power stations	Combustible substances (eg coal and coke dust), phenols, cyanides, sulphur compounds, asbestos
Transport	Garages, vehicle builders and maintenance workshops Railway depots	Combustible substances, hydrocarbons, asbestos
Mineral Extraction Land Restoration (including waste disposal sites)	Mines and spoils heaps Pits and quarries Filled sites	Metals (eg Cu, Zn, Pb), gases (eg methane), leachates
Water supply and sewage treatment	Waterworks Sewage treatment plants	Metals (in sludges) Micro-organisms
Miscellaneous	Docks, wharfs and quays Tanneries Rubber works Military land	Metals, organic compounds, methane, toxic, flammable or explosive substances; micro-organisms, asbestos

NOTE. Ubiquitous contaminants include hydrocarbons, polychlorinated biphenyls (PCBs) asbestos, sulphates and many metals used in paint pigments or coatings. These may be present on almost any site.

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(g) potentially combustible materials, eg coke residues. In general, materials whose calorific values exceed 10 MJ/Kg are almost certainly combustible. Materials below 2 MJ/Kg are unlikely to burn⁶;

(h) asbestos (see paragraphs 7 to 11).

Biological hazards are more rare, but include Weil's Disease where connections to live sewers have been carried out and pathogens such as tetanus, hepatitis B and very rarely anthrax or smallpox.

SPECIFIC CONTAMINANTS

7 Some contaminants are subject to specific legislation. Some may require advice from specialist authorities. Examples are given below.

Asbestos

8 Asbestos contamination may be found on many sites. On former waste disposal sites, derelict land etc, it is likely to be buried. Asbestos containing materials such as asbestos, cement or woven cloth, may have been buried on site as a convenient means of disposal. At some sites it may be found above ground, for instance when it has been used for heat insulation, fire control or in the construction of roofs of buildings.

9 Disturbance of the asbestos will cause fibres or dusts to be released into the atmosphere. This will be increased if the site is dry or the asbestos is friable, eg old lagging blankets, insulating boards or loose, unconsolidated deposits. Laboratory studies carried out on soil samples with asbestos materials have shown that measurable levels of airborne fibres can be generated from incorrect handling of ground which is contaminated with low concentrations of asbestos. If the site is wet, or contains articles such as asbestos cement boards, the release of fibres is likely to be reduced.

10 The Control of Asbestos at Work Regulations 1987 and Approved Codes of Practice will apply to any work with asbestos contaminated materials. The precautions to be taken will depend on the extent and type of asbestos, the condition of the site and the work to be carried out. For all asbestos contaminated materials the main aim should be to prevent its spread. The precautions should match the risk. Where high fibre levels could be anticipated (eg work with loose asbestos fibre materials), full protective clothing, high efficient or positive pressure respirators would be required. For other forms of material (eg removal of asbestos cement sheets), a lower standard of respirator would be

sufficient²⁰. Adequate personal washing facilities and vehicle wheel wash are important. The use of machines and damping down will reduce the risk.

11 Work such as large scale excavation and removal of asbestos, or removal of lagging waste will require additional precautions, including decontamination facilities, arrangements for disposal of contaminated clothing, segregation of areas. Dust suppression may well be necessary by spray application of water before work begins.

12 Monitoring of fibre concentrations may be necessary to check that the appropriate precautions are being taken and are effective eg at site perimeter (environmental control), boundary of the respiratory protective equipment zone, in cabs of vehicles in the contaminated area.

Radioactive contamination

13 Sites with radioactive contamination which are being developed may be subject to the Ionising Radiation Regulations 1985 and to the Radioactive Substances Act 1960. There are also specific regulations covering the carriage by road of radioactive substances. Before the site is developed the proposals for protecting site personnel and containing and safely removing the radioactive material should be agreed with HSE and HM Inspectorate of Pollution. It will probably be necessary to use specialist contractors for this work, to carry out regular monitoring as required, and to enclose the area where the radioactive material is being dealt with.

Buried explosives

14 In contrast to the possible effects of the substances listed above, those which might result from the disturbance of explosives could be sudden and have immediate serious effect. Off site consequences might occur. Therefore efforts should be made to prevent the event occurring, by firstly trying to obtain information on the site and the materials involved.

15 For the most part sites where explosives might be present fall into two groups. The first group comprises the discrete premises of former explosives factories and magazines; the second group consists of the ill defined areas which were used for wartime activities or which suffered from enemy action. Information on both groups should be sought in the locality. If the investigation suggests the presence of former factories and magazines, detailed information might be available from either the present explosives industry, or the successors to the original licensing authority.

16 Any excavation work at these sites should proceed with caution. Discolouration of the soil or finds of unusual objects (including lengths of shot firing cables) should be regarded as indicating the presence of explosives. Work should then stop until the substances or articles can be identified. The police should be informed and their advice followed. They may choose to call in the Explosives Ordnance Disposal Unit (EOD) from the armed services. If EODs are unable to assist then the explosives industry should be consulted.

17 Sites subject to wartime activity and areas subject to enemy action are more likely to involve items such as bombs, shells and rockets etc rather than substances. Any suspect articles of this type found during excavation should not be further disturbed. The site should be evacuated and the police called in. Well established procedures exist for dealing with unexploded munitions.

Lead

18 Work causing to exposure from lead is dealt with by the Control of Lead at Work Regulations 1980 and the Approved code of practice *Control of lead at work*¹³. Further advice is given in Guidance Note EH2922. Although the work with lead may be transitory there will be instances eg welding/cutting operations on lead painted or lead containing materials, when the exposure could be to very high concentrations of lead. The fact that such work is carried out in the open air cannot be taken to be indicating of a low level exposure to lead. It is possible for the work to be carried out close to the operative's breathing zone and therefore high concentrations of the dust or fume may be inhaled before it has had the chance to disperse. Such exposure is considered to be significant and the precautions needed are outlined in the above Approved Code. These will include the advice given in paragraphs 41 to 63 of this guide. Skin contamination followed by ingestion is also a major route of entry. Good training and personal hygiene are important for the control strategy. Containers such as heavy duty plastic bags should be provided for transporting contaminated protective clothing. Medical surveillance should be carried out.

Anthrax

19 Anthrax spores are liable to be found on any tannery or fellmonger site where the premises have been used for a number of years. They have also been found in premises previously used for the production of gelatin from crushed bone and in old wool sorting station. If the premises have been out of use for several years it may not be possible to identify with certainty high-risk areas, so the whole premises need to be regarded as a risk area. For work at farm sites,

contractors should ask Ministry of Agriculture, Fisheries and Food (MAFF) if anthrax-contaminated carcasses may be buried on sites (Tolworth 081-330 8086).

20 Anthrax most commonly develops when spores of *Bacillus anthracis* enter cuts or scratches in skin, resulting in the development of skin lesions. Sometimes anthrax may be contracted by inhalation of spores.

21 Where anthrax contamination is suspected, precautions based on good person hygiene (see paragraphs 49 to 54) and adequate protective clothing (see paragraph 58) to prevent or minimise skin contact with spores should be taken. Impervious clothing and gloves should be provided. All cuts and scratches (eg shaving cuts) should be covered. All people on the site should be made aware of the possible anthrax health risk and a recognised procedure, referring special cases to their GP, should be drawn up and brought to the attention of those liable to be affected.

22 If the risk is thought to be low, providing the above precautions are rigidly adhered to, a full programme of immunisation is not recommended but individuals should be made aware that immunisation is an additional precaution. It is important that all people who may be exposed to anthrax spores be advised of the necessary precautions and given a copy of the HSE pocket card on Anthrax MS(B)³²⁷.

SUMMARY OF RISKS ASSOCIATED WITH CONTAMINATED LAND

Skin absorption

23 Skin absorption of a range of materials may have a general effect if the material is absorbed into the bloodstream, or it may have a localised effect and cause skin irritation, dermatitis, or skin cancer. Dermatitis has frequently been observed in workers exposed to appreciable levels of arsenic dust by skin contact. Substances such as tars, oils and corrosive substances including grossly contaminated ground water can lead to skin irritation and possibly longer term skin sensitisation and dermatitis. Carcinogens such as naphthylamines and benzo-pyrenes may be met, and cyanides may cause related rashes.

Skin penetration

24 Materials may enter the body as a result of a puncture wound to the skin, and this is a common route of entry for microbiological hazards such as Leptospirosis (Weil's Disease), or Tetanus (Lock jaw).

Ingestion

25 Material may enter the mouth often from the fingers. This will arise if smoking and eating are allowed on site. Handling contaminated clothing outside the site may also present problems, especially if overalls are taken home and this should not be permitted.

Inhalation

26 Hazardous materials can be breathed in. The material may be a dust, a vapour, a gas, fumes or a mist. It may be mildly irritant or be highly poisonous. Examples are dust blown about the site and contaminated with a range of materials such as coal tars, heavy metals etc and toxic gases from the release of chemical reactions between mixed wastes, for example acid waste and complex cyanides in the mixture known as 'Blue Billy'. It is known that pitch residue dusts caused lung cancers in gas works staff. Vapours generated from wastes such as phenols and volatile aromatics could create problems. Asbestos dusts and lead fumes and dusts are well-known inhalation hazards.

Asphyxiation/gassing

27 Oxygen deficiency or gassing from hydrogen sulphide or sulphur dioxide, or other toxic gases may occur during excavation work of trenches, manholes etc and during entry into basements, tanks etc.

Fire/explosion

28 Flammable gases eg methane or hydrogen sulphide may exist in confined spaces, and if ignited lead to fire or explosion. Fires from materials which are still in the ground, eg coke or coal residues or tarry substances, may give rise to the evolution of toxic gases.

Initial considerations

29 Before work begins developers should always consider the possibility of the ground and associated buildings being contaminated and assess the risks to health and precautions required. All derelict land, whether or not previously used for the industrial processes already described, may be regarded as potentially suspect. A full site investigation including analysis of soil and water samples and a geotechnical survey should be carried out. Initially the responsibility lies with the client for carrying out such work. However, the main contractors must ensure that this has been done⁹.

30 The assessment of the level and nature of contamination indicated by the survey will determine the extent of the precautions required, but these need to be reviewed as unexpected problems arise during progress of the work.

31 Where possible the details of the contamination and an outline of precautions to be taken should be included within tender documentation. This can be a valuable basis on which contractors can make their assessments of risks to health and the precautions required. This is particularly important for those undertaking ground work, and would provide general guidance for a main contractor on the site as well. In some cases tender documentation has not only included details of contamination and precautions to be taken, but has also required that a sum be set aside for dealing with the precautions as a separate part of the tenders. This is to be recommended. It will allow the developer to assess estimates of the cost of the work, confident that control measures have been included. An occupational hygienist should be approached to provide general guidance and to provide a report giving details of precautions to be followed on the site.

32 Project design can greatly help to reduce the risk from the contaminated land. For instance, the contaminated area of the site or that most heavily contaminated can remain undisturbed by the appropriate siting of features such as car parks etc. Similarly, structures can be designed so as to avoid trench excavations by means of raft construction or shallow ground beams bearing on piles etc. Excavations which may create difficulty are those for underground services and again design can help to obviate the need for deep trenches in contaminated ground. This can be achieved by the use of features such as tumbling manholes at the perimeter of the site so as to reduce the depth of the excavations on site and the creation of broad common trenches of clean material in which statutory undertakers etc, might lay their services. Such an approach would follow the 'common trench' line of services coordination and installation.

33 It should be remembered that a number of organisations will be involved in the development of contaminated sites. The local authority will be actively involved from the environmental health and building control points of view. An environmental chemist, working for the local authority, may have drawn up preliminary details of local contamination as part of work on the local structure plan. The water authority will be concerned with respect to disposal of polluted water from such sites. The waste disposal authorities will be concerned with the disposal of other wastes. Good contact at an early stage with relevant authorities is particularly helpful with this work.

Contact with the public

34 When contaminated land sites are adjacent to public premises there is often considerable public concern, particularly with material such as asbestos or radioactive materials. Experience has shown that there are strong advantages in the contractor/developer keeping the local population informed, either directly or through the local authority so that the scale of the problem and any potential threat to the neighbourhood can be kept in proportion. Publicity directed at preventing children from entering sites is also useful.

PRE-START SURVEYS

Historical data

35 Historical data, if available, can provide valuable information on past use of sites and any potential for contamination. However, it is most important to go back far enough when looking at past use. For example, a warehouse of some long standing was found to have been built on an old gasworks site which had closed in the early 1900's. Important sources when carrying out such historical surveys include:

- (a) old maps and plans of the area, which may go back 200 to 300 years may be inspected at records offices and local libraries etc. These plans should be searched for evidence of old industries which may have long ceased to operate, eg creosote works and gelatine works. They may also identify forgotten or now covered boreholes. Old maps of specific works may exist, but care should be taken that all site layout changes have been incorporated. Plans of abandoned mines are available for inspection at Regional Mines Records Offices. These should be consulted if there is a likelihood of coal extraction industrial activity in the past. RMRO addresses are obtainable from HSE Mines Inspectorate offices or British Coal;
- (b) local authorities' planning departments;
- (c) former employers and employees of companies who may have occupied the site;
- (d) local residents who may have detailed knowledge of past usage of the site and the immediate neighbouring sites;
- (e) local industrial archaeological groups.

Site visit

36 Once historical information has been checked, the site should be inspected. The following are indications of possible contamination:

- (a) the remaining structures, including tanks, pipes, culverts etc;
- (b) obvious storage areas, pits etc;
- (c) inconsistent growth of vegetation, particularly where it is poor or apparently deformed;
- (d) surface materials, unusual colours or contours in the ground;
- (e) distinctive odours;
- (f) drums, containers etc, which may still be on the surface;
- (g) signs of fly-tip materials which could contain contaminated materials;
- (h) discoloured and/or smelly water in streams or pools;
- (i) bubbling or frothing of standing water may indicate gas pockets beneath.

Soil survey

37 Using data which has been obtained from the above survey, a soil sampling strategy should be developed. There is no single recommended approach for designing a sampling programme. Sampling needs to be carefully designed to suit the particular needs of each site, taking into account the methods of analysis to be used. Further information on this is given in DD175:1988¹¹.

38 A specialist contractor will need to be employed if necessary to carry out this type of work. The sampling strategy needs to be designed to achieve the best chance of detection and localised 'hotspots' of contaminants may make this more difficult. Again, using maps of the site can help. It is not unusual to find that contaminants occur in strata, though often these are in the top 0.5 - 1m layer. Maximum concentrations should be regarded as a critical determining factor, and as a minimum the precautionary measures chosen should adequately protect against the highest concentrations of contaminant found on site.

39 Soil surveys for geotechnical purposes may not indicate all local contamination and additional samples

may need to be taken albeit possibly at not such a great depth. The results of analysis of samples from trial pits, both solid and water samples, may be of more value as it is often the case that indications of the cause of the contamination (barrels, pipes, pieces of metal or equipment, etc) may be covered. Any soil samples should be at least at the depth of any excavation, remembering that water seepage may carry contamination from one part of a site to another.

Precautions to be taken by surveyors

40 Those engaged in these initial site surveys may be placed at risk by the survey itself. Therefore a minimum standard of protection should include:

- (a) protective clothing;
- (b) basic first aid box;
- (c) washing and changing facilities (a portable decontamination type facility may need to be brought to the site if a lengthy survey is to be carried out);
- (d) a flammable gas detector should be included if historical data suggest old mine workings or other possible source of a sudden release of methane eg prior use of site for landfill operations;
- (e) controlled entry into confined spaces where dangerous concentrations of vapours or oxygen deficiency may build up. There should however be no need for entry into confined spaces as materials can usually be obtained by mechanical means.

Further details of these matters are given below.

Assessment of risk

41 The contractor will need to assess the risk to workers from the various contaminants in order to decide the level of precautions required.

42 Some extrapolation can be done from the analysis of the soil in trial pits and bore holes to give an indication as to how much total dust the workers can be exposed to before the limits of adequate control are exceeded²³. Many of the heavy metals are unlikely to be present in concentrations (except for localised 'hotspots') that will present an inhalation risk. In assessing the inhalation risk from contaminants, ground conditions will play a strong role in determining the precautions to be taken. For instance very dry ground will enhance these risks.

43 The pH of water samples will be important. If very high or very low, alkali or acid burns could result from skin contact. Substances, such as phenols or coal tars, which can be absorbed through the skin, will require a higher standard of precautions, as will those that can be ingested, such as lead or cadmium.

44 Each site will need to be looked at individually.

Site organisation

45 The main contractor may need to engage an occupational hygienist to advise on the risks for contaminants found and the systems of work to be used, assist in training, analyse the waste and carry out air monitoring where appropriate. This should back up the need for training of the contractor's safety adviser/managers in contaminated land problems.

Precautions: control measures

46 The system of work will include provision of a range of measures to prevent or adequately control exposure to, and spread of contamination. These would include the following:

Defining the contaminated area

47 A designated 'dirty area', as determined by the site survey, should be clearly fenced off and suitable warning signs posted. The minimum standard of fencing acceptable for this area is cleft chestnut pale fencing to BS 1722 Part 4. The only access to or from the dirty area should be via a hygiene facility for personnel and via a controlled gate with a wheel wash (see paragraph 57) for vehicles required to enter and leave the dirty area. The main site office must be located in a clean area adjacent to the site. *See figs 1 & 2.*

48 A fence should be erected to enclose the site to provide security for out of hours working and to prevent unauthorised access on to the site and tipping. The fence and gate should be at least 2 m high and difficult to climb.

Hygiene

49 Achieving a good standard of hygiene is one of the most important aspects of the regime of protective measures to be taken. While the level of risk will determine whether the full range of measures outlined below need to be provided, the principles outlined should always be followed when working on a contaminated site.

FIG 1: GOOD SITING OF A HYGIENE AND FIRST AID FACILITY. NOTE: ACCESS TO DIRTY SIDE OF SITE THROUGH FIRST AID FACILITY FOR EMERGENCIES.

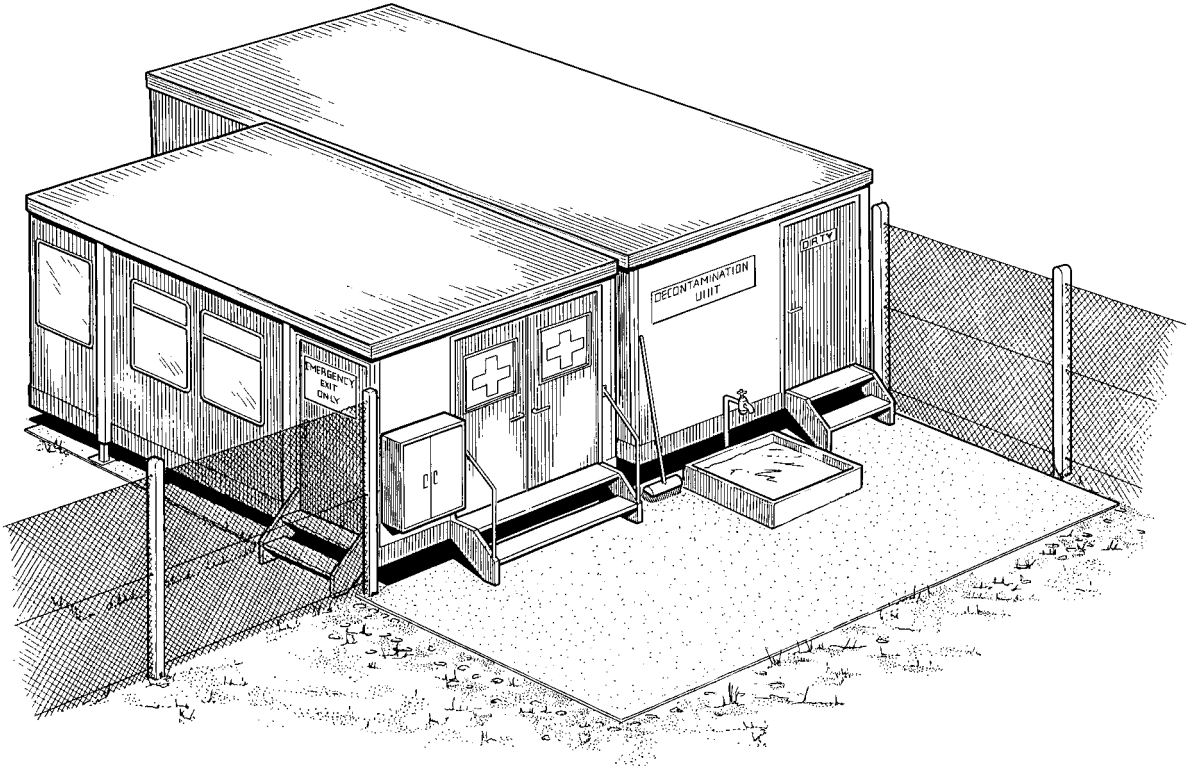
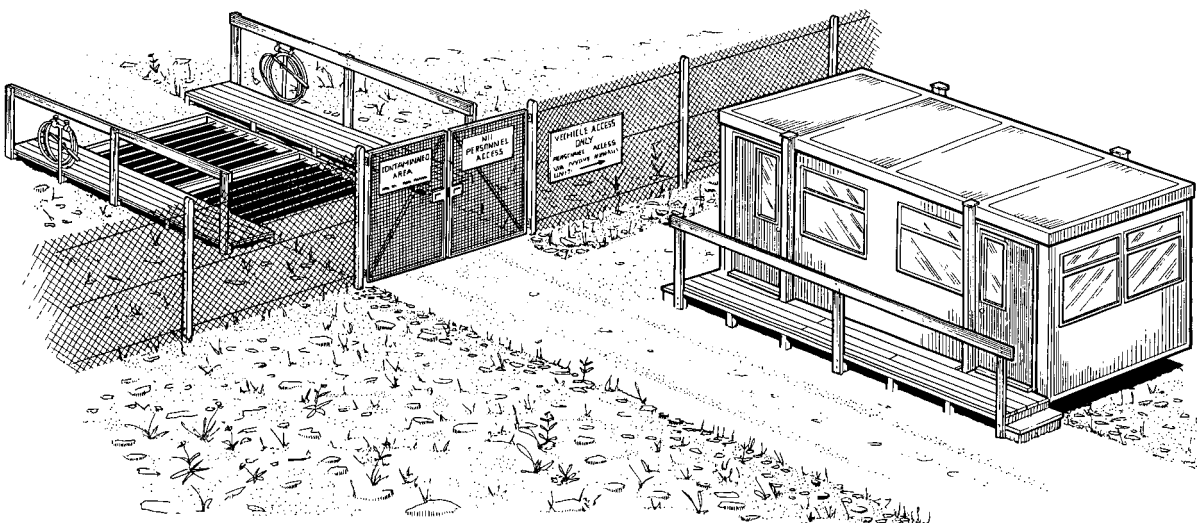


FIG 2: CONTROLLED VEHICLE ENTRY TO DIRTY SIDE OF SITE. NOTE WARNING SIGNS.



Installation of a hygiene facility

50 The hygiene facility may need to be purpose built if large numbers of personnel are on site, although a standard unit may be sufficient on smaller jobs. Units should be situated at the most convenient access point to or from the dirty zone.

51 The first stage of the unit should be for storage of ordinary clothing. The second should provide a high standard of washing facilities. The third stage should be used for the storage of contaminated overalls, footwear etc. The best form of washing facility is a deep trough sink where taps may be operated by elbows or feet which allows thorough washing of the forearms. Nail brushes, soap and disposable towels should also be provided. Where gross whole body contamination can be anticipated eg when working in contaminated trenches, showers will be necessary. They may also be necessary where conditions are particularly dusty although dust control should be the principal aim on site by means of water spray. See fig 3.

52 The positioning of the toilet facility may present problems. Because of the importance of maintaining a high standard of hygiene, toilet facilities should be situated so that workers must wash their hands prior to using these facilities. Whether full decontamination is required will depend on the levels of contamination being experienced. Daily cleaning of the toilet facilities and general decontamination of the unit must be carried out.

53 Services of water and electricity and possibly gas, will be required for the hygiene unit. When connecting these new services, the contractor should ensure that all old services have been made safe in the area to be excavated.

Eating and smoking

54 A canteen or messroom should be installed on the clean side of the site, which can only be entered by going through the hygiene unit. No eating or smoking should take place in the dirty area itself.

Boot wash

55 A boot wash should be situated immediately outside the entrance to the hygiene unit, and this should include running water and either fixed or hand brushes to remove contaminated soils.

Cleaning of cabs

56 The use of positive pressure cabs should be considered to prevent entry of contaminants, otherwise cabs of excavators etc, used on site, should be vacuumed out at the end of each day to avoid the build up of contaminants which could place the driver at considerable risk.

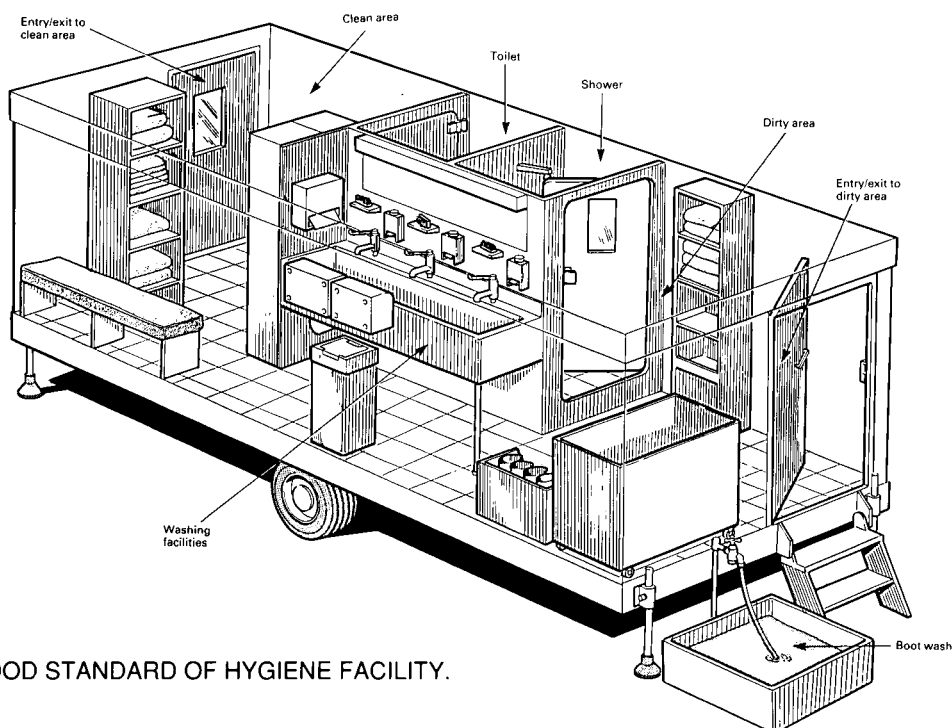


FIG 3: A GOOD STANDARD OF HYGIENE FACILITY.

Wheel wash

57 A wheel washing facility must be provided. Where vehicles enter or exit from the dirty area, this facility should be provided on the boundary of the dirty area. A high pressure hose which could effectively clean the wheels and undersides should be provided. Where vehicles are going to travel on public roads then vehicle washing should include the underbody and wheel arches. It may be necessary to collect water prior to disposal into sewers. This should be discussed by the developer with the local water authority. Wherever possible drivers should be encouraged to stay in the cabs of their vehicles to reduce the spread of contaminants. *See figs 4 & 5.*

Protective clothing

58 This should include safety wellingtons, hand protection and protective overalls.

- (a) overalls - disposable overalls are to be preferred to washable overalls to avoid laundering problems. In either case sufficient quantities should be provided. PVC overalls present problems due to excessive perspiration, but have been found necessary when wet weather working conditions occur. To prevent contaminants being retained in the overalls they should not have external pockets. To provide the maximum protection the overalls should be close fitting at the ankles and cuffs, preferably elasticated and should incorporate a hood. Experience shows that when disposable overalls are used, extra large sizes should be purchased, in order to increase their life. Thermal clothing may be necessary in winter to avoid workers wearing their own jackets over their overalls.

Contaminated clothing should be placed in double-skin plastic bags and sealed before disposal or laundering. In the latter case the laundry should be advised on the contaminant involved.

- (b) footwear - safety wellingtons should be worn and the overalls pulled down on the outside of the footwear;
- (c) hand protection - gauntlets should be worn to protect against abrasion and skin damage and to prevent contaminants being trapped under nails etc and ingested with food. With some contaminants impervious gloves will be required to prevent absorption through the skin;

- (d) respiratory protective equipment - where there is potential exposure through inhalation then respiratory protective equipment should be provided. RPE should be suitable for the purpose and of a type approved by HSE or in conformity with an HSE approved standard²⁰. For RPE to be judged 'suitable', employers should be able to show that their assessment has taken full account of:

- (i) the substances;
- (ii) the concentration of that substance;
- (iii) the duration of exposure;
- (iv) the pace of work;
- (v) environmental factors (eg heat);
- (vi) the requirements and limitations of the individual wearers and their jobs;
- (vii) other personal protective equipment that may need to be worn (eg ear defenders, visors etc); and
- (viii) the manufacturer's performance specification.

Information should be sought from manufacturers/suppliers about the range of use for which the RPE has been designed and the steps which should be taken to ensure that it meets the performance specification. Note that disposable respirators are designed for only limited use, which should never be exceeded. Except for one-shift disposable items, arrangements should be made for cleaning, storage, maintenance, regular examination, and testing (eg breathing apparatus).

59 Eye protection from splashes may also be necessary.

Confined space working

60 Where possible, entry into confined spaces, trenches etc should be minimised. Lining the sides of tunnels and excavations with sheeting during ground working can reduce contact with spoils etc. Confined spaces may be modified by battering the sides of the trenches. In certain circumstances, it may be possible to avoid a confined space by raising the overall structure. However, this is a matter which will need to be considered at an early stage. If entry is necessary then clear procedures should be developed for the entry into trenches, manholes, basements etc where there is a possibility of oxygen deficiency or asphyxiating or toxic

FIG 4. TYPICAL WHEEL WASH FACILITY

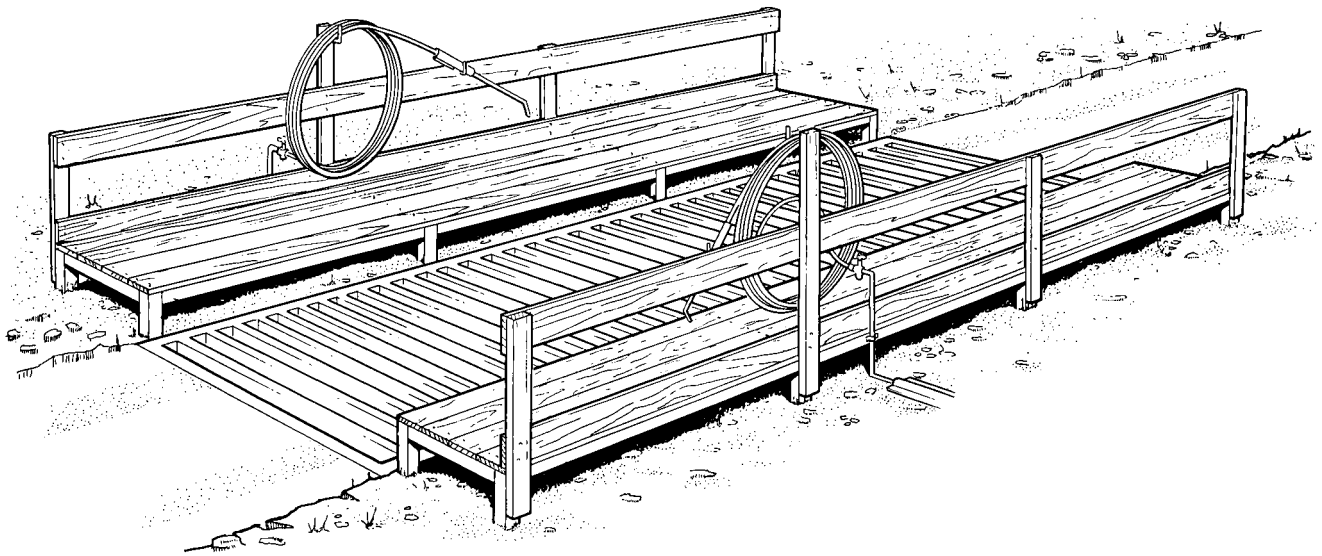
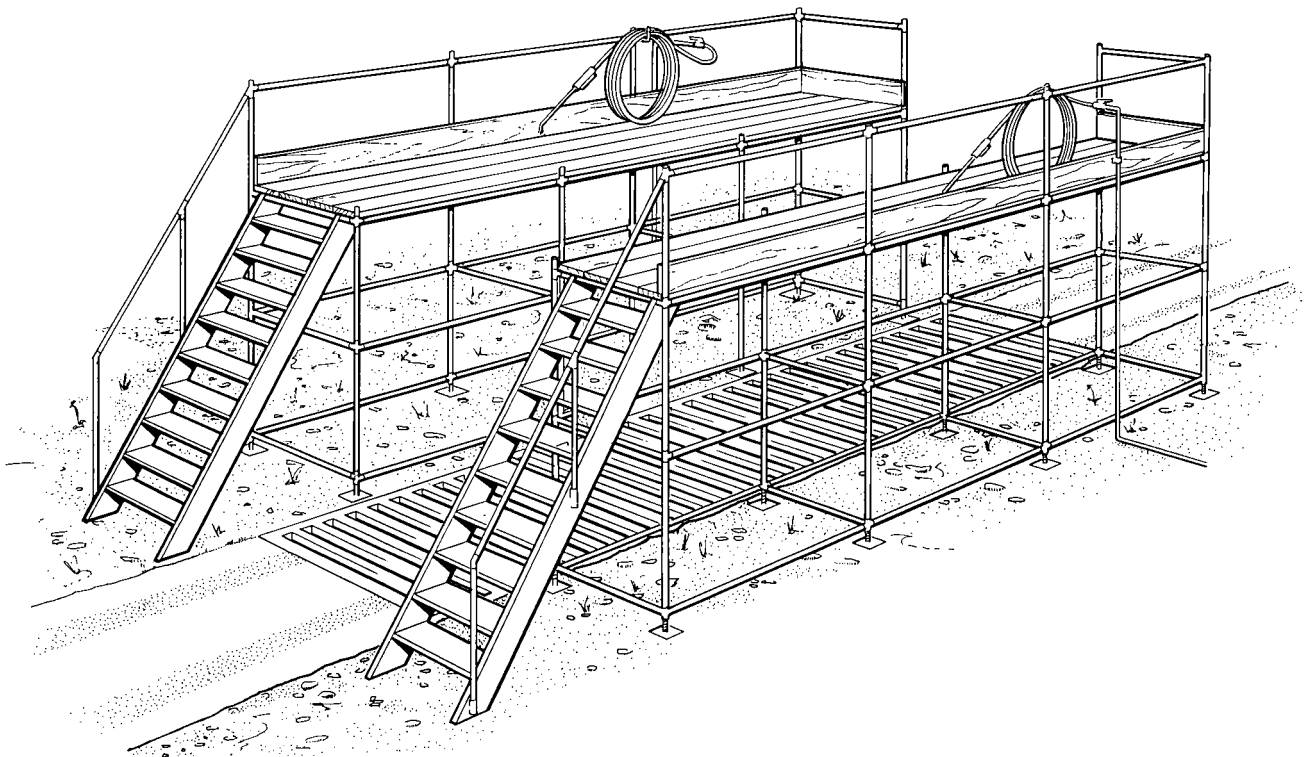


FIG 5. GANTRY TYPE WASH FACILITY FOR WASHING SIDES AND TOPS OF VEHICLES



gases²⁴. The standard pattern for entry into confined spaces should be followed:

- (a) testing for oxygen deficiency and explosive gases;
- (b) testing for the common toxic gases such as carbon dioxide and hydrogen sulphide, or other gases indicated by site contaminants;
- (c) ventilating the area as necessary;
- (d) entry into the area on harness and line with site supervision present;
- (e) providing emergency rescue procedures should anybody be overcome.

61 It is therefore necessary that breathing apparatus be provided on site where confined space working will take place. Those who may use the equipment must be fully trained in its use. It should be kept readily available, well maintained, inspected regularly and tested.

Control of dusts

62 Weather conditions such as hot dry days and operations such as those involving excavators etc may produce considerable quantities of dust which can be blown off site thus producing a possible risk to members of the public as well as to those working on site.

Precautions such as water sprays to dampen down dust should be taken where appropriate. If there is a risk of asbestos dust more stringent precautions will be needed (see also paragraphs 7 to 12).

Removal of wastes from site

63 Where contaminated materials are to be removed from site, it will be necessary to provide sheeting to open lorries or skips used for removal of contaminated soils. This should be carried out in a defined area on the dirty side of the site. Those carrying out sheeting should, wherever possible, avoid contact with contaminated soils. The provision of a gantry around the lorry to help sheeting makes the fitting of sheets easier. However, the construction of the gantry needs careful design.

64 Vehicle drivers should be discouraged from sheeting their own vehicles, except for final tightening of the ropes. Such final tightening can take place in a defined area on the clean side of the site. Vehicles should be well maintained so there is no risk of materials trickling out during travel. *See fig 6.*

65 Detailed records on the disposal of hazardous waste will be necessary and the main contractor should discuss this with the waste regulating authority prior to removal from the site.

FIG 6. FINAL SHEETING OF VEHICLE IN CLEAN AREA



HEALTH SURVEILLANCE AND FIRST AID

66 The employer should decide about the need for health surveillance as part of the COSHH assessment. Health surveillance is appropriate where:

- (a) a disease or adverse effect may be related to exposure; and
- (b) it is likely that this could arise in the circumstances of the work; and
- (c) there are valid techniques for detecting the disease or effect.

For example, work with cadmium, phenol, arsenic, will normally need health surveillance including biological monitoring of workers.

67 For work with substances which may cause skin cancer eg coal tar or pitch, skin inspections of workers should be done by a responsible person with relevant knowledge appointed by the employer, eg the trained first aider. Work with lead, asbestos and ionising radiations may require medical surveillance by an appointed doctor under the regulations applying to such work. The employment nursing adviser for the area should be consulted about the standards of training required.

68 There must be first aid provision for the workers on a contaminated land site. The first aid arrangements will depend on the nature and degree of hazards at the site, the hours of work, the availability of medical services, and the number of workers on site. Trained first aiders should have received training to deal with site specific hazards. Thus, if at a contaminated land site there is:

- (a) a danger of poisoning by certain cyanides or related compounds;
- (b) a need for oxygen as an adjunct to rescue in confined spaces;

enough employees eg first aiders, must be trained to deal with these specific matters²⁵.

69 To avoid entry of toxic materials through cuts or abrasions on the skin, first aid treatment should be given immediately. Wounds should be thoroughly cleansed using hot water and should be protected by waterproof coverings.

70 The first aider should examine all operatives' hands on a regular basis. Any bouts of nausea, giddiness etc should be immediately reported. The local hospital should be informed of the work and materials

likely to be encountered. Any gross contaminations should be treated immediately in hospital. Eyewash bottles should be available and any eye injury thoroughly irrigated prior to seeking medical attention.

71 It is most important that all visitors are taken through the same procedures as the work people on the site, and also maintain the same high standards.

72 Workers should be reminded of the advisability of maintaining immunisation against tetanus.

Information, instruction, training and supervision

73 Once procedures for work have been drawn up, information, instruction and training needs should be fulfilled so that employees know the risks and can apply the precautions required. It is important to reassure personnel that they can work safely on site despite the dangers, provided proper precautions are taken. The risks should not be exaggerated, nor employees frightened. In Appendix I there are some examples of the types of information that have been supplied on some sites. Strong supervision is an essential requirement. Without it the employer's duty to ensure use of precautionary measures may not be satisfied.

74 Experience has shown that when detailed information has been given to employees, backed up by strong supervision of the system, then a high level of compliance has been achieved. It is important that all personnel who come to the site receive adequate information and where necessary, training. Details of training should be recorded.

Site monitoring

75 Air monitoring of working positions (particularly in the cabs of excavators), within the hygiene unit and in the clean part of the site can give early warning that controls may be slipping on the site. Boundary samples may be useful in reassuring the public and water courses should also be checked. Sampling carried out during one development of a gaswork site showed little problem from airborne dusts, although some low levels of contamination were measured on very dry summer days. These did not present a risk to the public. However, this will not be the case for all sites and in any case total particulate monitoring is relatively cheap, technically easy and quick. It can also provide a monitor for dust levels. A high standard of visual monitoring should be ensured. This should be directed at the following matters:

- (a) identification of areas of contamination;

-
- (b) identification of any spread of contamination between areas, through underground pipes or trenches etc during excavation work;
 - (c) control of clean and dirty materials and sampling of materials as they are moved off site;
 - (d) ensuring that safe working practices and protective equipment are being used.

DECLARING THE SITE CLEAR

76 Before work commences a decision should be made on the amount of contaminated material that is

required to be removed before the site can be declared clear. When some materials are to remain and groundworks are to take place in a contaminated area, then a decision is needed as to the stage at which the groundworks can be regarded as contaminant free. These decisions will provide a level against which site management can monitor progress, and provided conditions are found to be as assessed at the start, management can decide whether normal site procedures can commence. Management should formally decide when a site is free from contamination, so that unnecessary fencing and decontamination facilities can be removed.

APPENDIX 1 - EXAMPLES OF INFORMATION

Some examples of information given out to employees by contractors

INFORMATION FOR MEDICAL PRACTITIONERS

The person named on this card has been working in an area where toxic substances, in the form of waste spoil has been located and may have had direct contact.

Please ring any of the following numbers for information on toxic substances being removed.

.....
.....
.....

General indications

- Impaired coordination
- Skin irritation
- Defatting and dermatitis
- Conjunctivitis
- Personality change
- Tremors
- Loss of appetite
- Nausea
- Diarrhoea
- Constipation
- Affecting nervous system
- Laryngitis
- Cough
- Chest pains
- Headache
- Pains in joints

INSTRUCTIONS TO PEOPLE WORKING IN CONTACT WITH CONTAMINANTS

Whenever you go to hospital or to your doctor on account of illness, show this card and make sure that those attending you know your occupation

Any change of address of yourself or your doctor must be notified to the site office immediately

TO THE MEDICAL PRACTITIONER: Please refer to the information printed on the back of this card

TO BE COMPLETED IN BLOCK LETTERS PLEASE

Employee's Name

Address

.....

.....

Occupation

Doctor's name

Address

.....

.....

Telephone number

Address

.....

.....

If taken ill, go to your doctor or ask them to visit you. You must also advise the site office by telephone or telegram, without delay.

INSTRUCTIONS TO WORKERS

Precautions against risk working in toxic areas

1 After working in contact with toxic soils or water contaminated by toxic soils, wash your hands and forearms thoroughly with soap and water and use the disinfectant provided. If your clothes or boots are contaminated wash thoroughly after handling them. This is particularly important before taking any food or drink, or before smoking. Protective clothing should be placed in the contaminated clothing container for disposal or laundering.

2 Make a special point of washing thoroughly any cut, scratch, or abrasion of the skin as soon as possible whether the injury was caused at work or not. Then apply an antiseptic to the wound with a clean piece of cloth or cotton wool and protect it with a strip of gauze completely covered with adhesive plaster. Keep the wound covered until it is quite healed. Antiseptic gauze

and impermeable plaster are available from your first aider.

3 Further treatment is a matter for your doctor. Whether the injury appears serious or not you should visit him, show him/her your card and tell him that the injury was sustained in the course of your work.

4 Avoid rubbing your nose or mouth with your hands during work.

5 Keep this card in a safe place and whenever you go to a doctor or to a hospital on account of illness, show this card and make sure that those attending you know you have been working in contact with toxic soils.

Every accident at work, no matter how trivial, must be reported to your site office at once.

Should you lose or damage this card, ask your site office for a new one, without delay.

SITE INSTRUCTIONS FOR STAFF AND SUB-CONTRACTORS

The problem

The site is an old gas works and the ground contaminated with harmful chemicals, Concentrations vary, but we must assume they are high everywhere.

How could you get hurt

- By eating (ingesting) contaminated material.
- By breathing (inhaling) harmful dust or fumes.
- By getting some of the chemicals on your skin or in cuts or scratches.

1 You must separate yourselves from the contaminated soil by wearing the protective clothing **always**.

2 You must wash before eating and at the end of each work period.

3 You must not smoke because the process of smoking may lead to ingestion of contaminated soil.

4 You must not eat on site, because of the risk of ingesting contaminated soil. Eat only in the canteen.

5 If you get any tar-like substances on your skin, wash them off with a proprietary cleaner, followed by soap and water, and change your clothes.

6 If you have even the slightest cut or scratch, get it thoroughly cleaned by the First Aider and covered with a waterproof dressing.

7 You must leave your non-working clothes in the lockers provided and put on your overalls before work. Clean overalls will be provided as necessary.

8 When leaving site, put your protective clothes in the dustbin provided, shower and wash thoroughly with the soap provided.

9 You must report any health disorder to the First Aider or the site Safety Officer - headaches, stomach aches, etc.

10 You must not go into any trench, pit or other confined space unless you or your supervisor has a permit to work current for the work being done.

11 Report to your supervisor if:

(a) You see any patches of thick black material, blue powders or yellow powders. Keep clear;

(b) You smell anything, especially rotten eggs. Keep clear;

(c) You see any sign of fire. Keep clear;

(d) You find any old containers. Keep clear.

APPENDIX 2

Guidelines for classification of contaminated soils

Guidelines for classification of contaminated soils - suggested range of values (parts per million) on air dried soils, except for pH.

Parameter	Typical values for uncontaminated soils	Slight contamination	Contaminated	Heavy contamination	Unusually heavy contamination
	A	B	C	D	more than E
pH (acid)	6-7	5-6	4-5	2-4	(less than 2)
pH (alkaline)	7-8	8-9	9-10	10-12	12
Antimony	0-30	30-50	50-100	100-500	500
Arsenic	0-30	30-50	50-100	100-500	500
Cadmium	0-1	1-3	3-10	10-50	50
Chromium	0-100	100-200	200-500	500-2500	2500
Copper (available)	0-100	100-200	200-500	500-2500	2500
Lead	0-500	500-1000	1000-2000	2000-1.0%	1.0%
Lead (available)	0-200	200-500	500-1000	1000-5000	5000
Mercury	0-1	1-3	3-10	10-50	50
Nickel (available)	0-20	20-50	50-200	200-1000	1000
Zinc (available)	0-250	250-500	500-1000	1000-5000	5000
Zinc (equivalent)	0-250	250-500	500-2000	2000-1.0%	1.0%
Boron (available)	0-2	2-5	5-50	50-250	250
Selenium	0-1	1-3	3-10	10-50	50
Barium	0-500	500-1000	1000-2000	2000-1.0%	1.0%
Beryllium	0-5	5-10	10-20	20-50	50
Manganese	0-500	500-1000	1000-2000	2000-1.0%	1.0%
Vanadium	0-100	100-200	200-500	500-2500	2500
Magnesium	0-500	500-1000	1000-2000	2000-1.0%	1.0%
Sulphate	0-2000	2000-5000	5000-1.0%	1.0-5.0%	5.05
Sulphur (free)	0-100	100-500	500-1000	1000-5000	5000
Sulphide	0-10	10-20	20-100	100-500	500
Cyanide (free)	0-1	1-5	5-50	50-100	100
Cyanide	0-5	5-25	25-250	250-500	500
Ferricyanide	0-100	100-500	500-1000	1000-5000	5000
Thiocyanide	0-10	10-50	50-100	100-500	2500
Coal Tar	0-500	500-1000	1000-2000	2000-1.0%	1.0%
Phenol	0-2	2-5	5-50	50-250	250
Toluene extract	0-5000	5000-1.0%	1.0-5.0%	5.0-25.0%	25.0%
Cyclohexane extract	0-2000	2000-5000	5000-2.0%	2.0-10%	10.0%

Note: Taken from Site investigation and materials problems, Proc Conference on Reclamation of Contaminated Land, Eastborne, October 1979 (Society of the Chemical Industry, London 1980)

REFERENCES

1 ICRCL 17/78 Notes on the Redevelopment of Landfill Sites. Seventh Edition May 1988.

2 ICRCL 18/79 Notes on the Redevelopment of Gas Works Sites. Fifth Edition April 1986.

3 ICRCL 23/79 Notes on the Redevelopment of Sewage Works and Farms. Second Edition November 1983.

4 ICRCL 42/80 Notes on the Redevelopment of Scrap Yards and Similar Sites. Second Edition October 1983.

5 ICRCL 59/83 Guidelines on the Assessment and Redevelopment of Contaminated Land. Second Edition July 1987.

6 ICRCL 61/84 Notes on the Fire Hazards of Contaminated Land. Second Edition July 1986.

7 ICRCL 64/85 Asbestos on Contaminated Sites. Second Edition in course of preparation.

Available from Department of the Environment Publications Sales Unit, Building 1, Victoria Road, South Ruislip, Middlesex HA4 ONZ.

8 Department of the Environment Problems arising from the Redevelopment of Gas Works and Similar Sites. Second Edition November 1987. HMSO 1988.

9 Development of Contaminated Land. DoE Circular 21/87/Welsh Office Circular 22/87. HMSO 1987.

10 Building Research Establishment Fire and Explosion Hazards Associated With the Development of Contaminated Land. BRE Information Paper 2/87 D Crowhurst and P F Eever, April 1987. Available from BRE

11 British Standards Institution: Draft for Development DD 175: 1988 Code of Practice for the identification of potentially contaminated land and its investigation.

12 The Shipham Report. An investigation into Cadmium Contamination and its implications for Human Health. H Morgan and D L Simms. The Science of the Total Environment 75(1) 1988

13 HSE: Control of lead at work: Approved code of practice: Revised June 1985

14 HSE: Work with asbestos insulation, asbestos coating and asbestos insulating board. Revised Approved code of practice 1988.

15 HSE: The Control of Asbestos at Work Regulations 1987: Approved Code of Practice (COP 21).

16 HSE: The provisions, use and maintenance of hygiene facilities for work with asbestos insulation and coatings Guidance Note EH47.

17 HSE: Respiratory protective equipment for use against asbestos (Guidance Note EH41)

18 HSE: Approved code of practice 1988. Control of Substances Hazardous to Health: Control of Substances Hazardous to Health Regulations 1988.

19 HSE: COSHH Assessments: A step by step guide to assessments and the skills needed for it, Control of Substances Hazardous to Health Regulations 1988.

20 HSE: Respiratory Protective Equipment (RPE), a practical guide for users. (HS(G)53)

21 HSE: Protection of Persons Against Ionising Radiation Arising From Any Work Activity: The Ionising Radiations Regulations 1985: Approved Code of Practice 1985.

22 Health and Safety Executive: Control of Lead: Outside Workers Guidance Note EH29 1981

23 Health and Safety Executive: Occupational Exposure Limits Guidance Note EH40 1988

24 Health and Safety Executive: Entry into Confined Spaces Guidance Note GS5

25 HSE: Approved code of practice First Aid at Work and IND(G)3(L) 1990

CONSTRUCTION ADVISORY COMMITTEE

26 Substances Hazardous to Health in the Construction Industry. HMSO ISBN 018855263.

27 Ms(b)3 Anthrax