

Appendix T

AMEC Land Quality Technical Note



Generic Quantitative Risk Assessment - Runway Resilience

General

This technical note presents a Generic Quantitative Risk Assessment (GQRA) of the chemical soil results of a site investigation carried out by Scott Wilson (on behalf of Morgan Sindall) at Heathrow Airport in the areas of the airfield where the new sections of taxiway are planned. The intrusive investigation involved the excavation of 28 machine excavated trial pits to a maximum depth of 2.1m. Disturbed samples were taken at depths of between 0.2m and 0.9m below ground level and were despatched to Envirolab for examination and testing. The analysis focussed on general land quality indicators and the common pollutants associated with airports. Analysis included the following determinands:

- Total Petroleum Hydrocarbons (TPH);
- Metals (arsenic, cadmium, copper, chromium, lead, mercury, nickel;
- selenium and zinc);
- Sulphate;
- pH; and
- Organic matter.

Assessment Guidelines

Chemical analysis data for soils have been compared with generic assessment criteria (GAC), where available, in order to identify contaminants of concern and determine whether further assessment of risks is required. The assessment criteria used depends upon the source media (soil, groundwater, gas) and the receptor under consideration. This GQRA is concerned with soil samples only and is focussed on human receptors for a commercial end use, although consideration has been given for other receptors.

Human Health Guidelines

Contaminated Land Exposure Assessment (CLEA) Soil Guideline Values

The principal screening criteria used for this study with respect to human health are the CLEA Soil Guideline Values (SGVs). These are generic assessment criteria derived by Defra and the Environment Agency. A former version of the CLEA model and associated SGVs were withdrawn on 12th August 2008 and replaced with a revised CLEA model. At the time of report preparation revised SGVs for the following contaminants (which were analysed) have been published and have been used for the assessment of risks to human health:

- Metals (arsenic, cadmium, mercury, nickel and selenium); and

- BTEX (benzene, toluene, ethylbenzene and xylenes).

In addition, published SGVs relating to the former version (pre August 2008) of the CLEA model have been used for the following contaminants:

- Metals (lead).

SGVs for organics are derived for particular soil conditions (6% Soil Organic Matter (SOM)). As SOM can vary, the CLEA model has been used to generate GAC (see below) for the above contaminants for SOMs of 1% and 3% and for a commercial land use scenario.

Chartered Institute of Environmental Health (CIEH)/ Land Quality Management (LQM), EIC/AGS/CL: AIRE and AMEC GAC

Where there are no published SGV values, CIEH/LQM GAC have been used, and in their absence, EIC GAC or AMEC GAC. These were also generated using the current version of the CLEA software and published in July 2009. These GAC have been used for the assessment of risks to human health for:

- Metals (chromium, copper and zinc);
- Total Petroleum Hydrocarbons (TPH) speciated using the CWG;
- Methodology; and
- BTEX (benzene, toluene, ethylbenzene and xylenes) for 1% and 6% SOM.

Other Receptor Guidelines

BRE Special Digest I, Concrete in Aggressive Ground (SD1:2005)

The 2005 edition (supplementing the 2001 edition) of the BRE Special Digest includes revisions to the procedures for ground assessment and specification of below ground concrete design. Particular attention has been given to recent findings on sulphate attack and incorporation of European standards. The guidance provides more conservative classifications on concrete design sulphate classes from 2:1 water/soil extractions and provides an Aggressive Chemical Environment for Concrete (ACEC) classification. Design sulphate (DS) classes range from DS-1 (least aggressive) to DS-5 (most aggressive) and enable by comparison with pH a corresponding ACEC Class (AC-1 to AC-5) to be determined.

Soil Organic Matter (SOM)

Organic matter was analysed as part of the site investigation. The laboratory analysis recorded values ranging between 0.1% and 9.4% with an arithmetic mean of 1.052%. Where applicable, the screening values have been chosen using an SOM of 1%.

Comparison with Generic Assessment Criteria

Observed soil concentrations have been compared to the GAC (discussed above) relevant for an industrial/commercial use for all samples. The comparisons are presented below. The soils results compared with relevant GAC are provided in **Appendix A**.

Soils Analysis

The pH values varied between 5.5 and 12, with an arithmetic mean of 7.96. It is therefore considered that there is a broad range of soil pH values across the site.

Metal and Inorganic Contaminants

25 samples were analysed for sulphate, arsenic, cadmium, chromium¹, lead, mercury, nickel, selenium and zinc. 17 samples were analysed for copper. The metal concentrations were all generally low for a commercial use and were significantly less than the relevant GAC.

Water soluble sulphate concentrations varied between <0.01g/l and 1.00g/l with an arithmetic mean of 0.1g/l. Based on BRE GAC this places the majority (26 of 27) samples within design sulphate class DS-1 (<0.5g/l) with a corresponding ACEC Class of AC-1. One sample (TP7 0.4-0.5m) contained water soluble sulphate concentrations indicating a design sulphate class DS-2 (0.5g/l – 1.5g/l) with a corresponding ACEC Class of AC-2.

Organic Contaminants

Analysis of organic hydrocarbons was not speciated and only total petroleum hydrocarbons (TPH) were tested for. The results of the TPH analysis were therefore compared with the most stringent organic contaminant guidelines for an industrial/commercial use (Aliphatic fraction EC8-10 being the lowest). 25 samples were tested for TPH and all samples revealed concentrations of TPH well below the relevant GAC. 21 of the samples were below the detection limit of <10mg/kg. Soils analysis did not include testing for polycyclic aromatic hydrocarbons (PAH).

Summary

A total of 27 samples were taken from the site and sent for chemical soil analysis. 27 of these were tested for pH and sulphate, 25 were tested for organic matter, TPH, arsenic, cadmium, chromium, lead, mercury, nickel, selenium and zinc and 17 samples were tested for copper. PAH were not analysed.

None of the samples analysed were detected in concentrations exceeding the relevant GAC for an industrial/commercial use. Furthermore, some of the areas will be covered in hardstanding further mitigating exposure to soils. In addition, softstanding areas will have imported 'clean' soils that will prevent exposure to underlying soils. The areas are unlikely to be manned for significant periods of time so GAC are conservative and there were no exceedances anyway.

The majority of the soils indicate a design sulphate class DS-1, with a corresponding ACEC Class of AC-1.

With the general absence of high contaminant concentrations, qualitatively risks to services and groundwater are considered to be low.

¹ Results presented do not indicate whether CrIII or CrVI has been analysed – usually where not defined results relate to total Cr. Total Cr is usually predominantly CrIII, thus, this is the GAC that has been adopted.