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# Grenfell Investigation into Potential Land Contamination Impacts

## Technical Note 09: Published Data on National and Regional Urban Background Soil Concentrations

Royal Borough of Kensington and Chelsea

Project number: 60595731

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## Quality information

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# 1. Introduction

This technical note (TN) presents the scope, methodology, results and conclusions of the desk-based Evidence Review (ER) of background concentrations of Chemicals of Potential Concern (COPC[1]; as identified in the fire chemistry evidence review[2]) in urban soils, focusing on London and the UK. This QSR was conducted to support the Stage 1 investigation of potential land contamination impacts resulting from the Grenfell Tower fire.

# 2. Methodology

The ER was completed in accordance with the Quick Scoping Review (QSR) protocol described in AECOM's TN for the ER[3]. The protocol for the QSR of background concentrations of COPC is reproduced below as **Table TN09-01**, below.

### Table TN09-01: ER Protocol for QSR of urban background concentrations of COPC

| Protocol Element | |
|---|---|
| Authors: | AECOM |
| Background rationale: | Requirement to understand the range in reported concentrations of fire effluent chemicals in urban soils. |
| Objective: | Identify the range of reported urban background soil concentrations for the COPC (priority chemicals) identified by the fire chemistry evidence review. |
| Scope: | Focus on large geographical studies for urban areas (i.e. not individual sites). Focus on London.<br>Limited to UK.<br>Limited to English language only.<br>Limited to studies from year 2000 onwards |
| Method: Search keywords | Urban, soil, pollutant, contaminant, concentration, background. |
| Method: Search strategy | Published UK surveys or open source data from UK government organisations or institutions: BGS, Defra, Environment Agency.<br>Google Scholar search using Boolean search terms constructed from the keywords above.<br>PubMed search as per Google Scholar search.<br>ResearchGate search as per above. |
| Method: Inclusion and exclusion criteria | Exclude data before 2000.<br>Exclude data outside UK. |
| Method: Information extraction | Initial extraction from abstract only. Selection of full papers was based on the results of the first phase screening. Information was recorded as per the evidence template. |
| Information synthesis: | Included:<br>Descriptive characteristics of evidence identified.<br>A narrative synthesis of the evidence.<br>Available digital data to be transferred to GIS if available in correct format. |

Changes made to this protocol during the QSR were as follows:

[1] Also referred to as "priority chemicals" in other Technical Notes.
[2] TN04: Fire chemistry and identification of COPC.
[3] TN02: Protocol for evidence review.

- If too many irrelevant search results were produced, or the search keywords listed above gave no results, extra search keywords were added, or Boolean search terms and advanced search features of search engines were used to aid the search. Search terms are and results are presented in **Appendix TN09-A**, appended.
- The Natural Environment Research Council's document on-line publication database (NERC Open Research Archive (NORA)) was added to the list of search tools. The same search method was used for this portal as for other search locations.
- In some searches on GOV.UK, Data.gov.uk and NORA on-line databases the results were filtered to only display results from relevant organisations that could hold data on background levels of COPC in the UK (Environment Agency; DEFRA; Food and Environment Research Agency; Centre for Environment, Fishery and Aquatic Science; and the Coal Authority).
- If a researcher with relevant publications was identified using the methods above their name was added to the search keywords.
- The original format of **Appendix TN09-B** was modified to indicate if a reference was taken forward to more detailed review. If not, a reason was given in an adjacent column in this Table.
- The original format of **Appendix TN09-C** was modified to present key details for selected data sources in a tabular format instead of paragraphs of text.

## 2.1 Review Questions

The primary question to be answered by this ER was:

- What is the range of reported urban background soil concentrations in London or UK soils for the COPC (priority chemicals) identified by the fire chemistry evidence review?

The following secondary questions were identified:

- Which COPC are background data available for?
- Where were the data collected from?
- What sampling and analysis methods were used?
- What are the reported ranges of each COPC in urban soils in London or across the UK?
- Which COPC have no background data available, based on the search results?

# 3. Results

The search of published UK surveys, open source data from UK government organisations and on-line databases identified 48 individual references for further screening. These are listed in **Appendix TN09-A**, appended to this Technical Note.

The selected search results were then reviewed in more detail to obtain a summary or overview of the information presented on background concentrations of COPC in urban soil. The results of this second level of screening are presented in **Appendix TN09-B**, appended. Based on review of these summaries of search results, nine individual references were selected for more detailed review.

Each of the selected search results were then reviewed to assess if it contained relevant information to answer the primary and secondary questions of this ER. The pertinent information from this third level of screening is presented in **Appendix TN09-C**, appended to this Technical Note. Key data on background concentrations of COPC[4] in urban soil in London, or across the UK, were taken from these sources and are summarised in the conclusions[5], below.

[4] Names of individual COPC are those used in the evidence cited and no conversion to synonyms has been made in this Technical Note.
[5] Where COPC have been described as groups of organic chemicals e.g. Polycyclic Aromatic Hydrocarbons (PAHs) then data for the full range of substances listed in the cited evidence have been included, rather than filtering to a limited analytical suite. If a specific substance is not listed, then this indicates that no data was available for it in the evidence cited.

# 4. Conclusions

## 4.1 Trace and Major Elements

For trace and major elements, including metals and metalloids, the London Earth study (summarised in (Johnson, et al., 2011)) provided data for top soil in London and the UK Soil and Herbage Survey (UKSHS) presented data for urban soils across the UK.

The UKSHS study presented data for 13 trace metals and metalloids (arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, platinum, titanium, tin, vanadium and zinc) in soils from 29 urban sites[6] across the UK (Ross, et al., 2007). Statistical summaries for metals / metalloids to be analysed in the current project are presented in **Table TN09-02**.

The London Earth study is part of a nationwide project to assess the distribution of chemical elements in the surface environment, namely the Geochemical Baseline Survey of the Environment (G-BASE). London Earth focuses on the soil of the capital city, the limits of the survey being defined by the administrative area of the Greater London Authority (GLA). Soil sampling campaigns were carried out from 2005 to 2009, analyses were completed in 2010 and analytical data is available for over 50 elements (statistical summaries for metals / metalloids to be analysed in the current project are presented in **Table TN09-02**).

### Table TN09-02: Background concentrations of trace and major elements in urban soils

(Source: (Johnson, et al., 2011) and (Ross, et al., 2007))

| Analyte | Units | Min. | Median | Mean | Max. | Std. Dev. | Range | Number | Source |
|---|---|---|---|---|---|---|---|---|---|
| Aluminium ($Al_2O_3$) | wt% | 0.80 | 7.50 | 7.99 | 20.80 | 2.76 | 20.00 | 6467 | London Earth |
| Arsenic (As) | mg/kg | 1.20 | 15.40 | 17.08 | 160.90 | 8.64 | 159.70 | 6467 | London Earth |
| As (UK-Urban) | mg/kg | 1.75 | 9.78 | 10.97 | 32.00 | 6.98 | 30.25 | 87 | UKSHS |
| Barium (Ba) | mg/kg | 143.50 | 379.50 | 402.60 | 3475.10 | 147.94 | 3331.60 | 6467 | London Earth |
| Cadmium (Cd) | mg/kg | 0.00* | 0.60 | 0.99 | 165.20 | 3.22 | 165.20 | 6467 | London Earth |
| Cd (UK-Urban) | mg/kg | 0.10 | 0.29 | 0.44 | 2.39 | 0.41 | 2.29 | 87 | UKSHS |
| Chromium (Cr) | mg/kg | 14.70 | 72.00 | 77.98 | 2094.30 | 48.29 | 2079.60 | 6467 | London Earth |
| Cr (UK-Urban) | mg/kg | 9.10 | 27.10 | 33.94 | 122.00 | 21.46 | 112.90 | 87 | UKSHS |
| Copper (Cu) | mg/kg | 3.20 | 46.10 | 72.40 | 5325.50 | 142.68 | 5322.30 | 6467 | London Earth |
| Mercury (Hg) | mg/kg | -4.00* | 0.00* | 0.16 | 33.80 | 1.37 | 37.80 | 5964 | London Earth |
| Hg (UK-Urban) | mg/kg | 0.07 | 0.23 | 0.35 | 1.53 | 0.29 | 1.46 | 87 | UKSHS |
| Nickel (Ni) | mg/kg | 2.30 | 25.40 | 27.99 | 505.60 | 15.80 | 503.30 | 6467 | London Earth |
| Ni (UK-Urban) | mg/kg | 7.07 | 22.00 | 28.19 | 102.00 | 21.83 | 94.93 | 87 | UKSHS |
| **Lead (Pb)** | **mg/kg** | **10.80** | **180.10** | **295.60** | **10000.00** | **430.44** | **9989.20** | **6467** | **London Earth** |
| **Pb (UK-Urban)** | **mg/kg** | **8.60** | **93.00** | **110.65** | **387.00** | **80.71** | **378.40** | **87** | **UKSHS** |
| Selenium (Se) | mg/kg | -0.10* | 0.60 | 0.67 | 19.60 | 0.60 | 19.70 | 6467 | London Earth |
| Vanadium (V) | mg/kg | 15.70 | 76.40 | 82.90 | 302.30 | 28.57 | 286.60 | 6467 | London Earth |
| V (UK-Urban) | mg/kg | 12.80 | 43.00 | 46.85 | 131.00 | 24.72 | 118.20 | 87 | UKSHS |
| Zinc (Zn) | mg/kg | 0.00* | 154.50 | 221.30 | 10095.00 | 292.29 | 10095.00 | 6467 | London Earth |
| Zn (UK-Urban) | mg/kg | 35.10 | 97.00 | 122.06 | 521.00 | 89.58 | 485.90 | 87 | UKSHS |

*London Earth: summary statistics taken from* (Johnson, et al., 2011). *Contains BGS Summary Statistics Data of London Earth Topsoil Results CP19/045 BGS © UKRI 2019.*

[6] For UKSHS data, an Urban area is defined as ≥90 % urbanised/built up. A conurbation may be formed when a large town and city merge. These include large towns (20–50 $km^2$ in area) and cities (> 50 $km^2$ in area).

*UKSHS: Statistical values (Mean, Median, Range, Standard Deviation (Std. Dev.), Maximum (Max.) and Minimum (Min.)) were calculated using measured urban soil values presented in the UKSHS Data Package.*
**: Minimum values with negative numbers or zero values are as reported in the evidence.*
*Analytes highlighted in bold (e.g. lead (Pb)) are identified COPC for fire effluents.*

## 4.2 Polycyclic Aromatic Hydrocarbons (PAHs)

(Vane, et al., 2014) reported data for top soil samples collected in 2009 from the Abbey Wood, Thamesmead, Erith, Belvedere and Jenningtree Point areas of London. In the study 33 PAHs were analysed. Statistical summaries of these results are presented in **Table TN09-03**.

Report No. 9 in the UKSHS report series presents data on 21 PAHs in soil samples collected from urban sites in the UK (Creaser, et al., 2007b). Statistical summaries of these data are presented in **Table TN09-03**.

### Table TN09-03: Background concentrations of PAHs in urban soils

(Source: (Creaser, et al., 2007b) and (Vane, et al., 2014)

| PAH | Units | Min. | Median | Mean | Max. | Std. Dev. | Range | Number | Source |
|---|---|---|---|---|---|---|---|---|---|
| 1-Methylnaphthalene | mg/kg | 0.032 | 0.099 | 0.112 | 0.363 | 0.06 | 0.331 | 76 | Vane |
| 1-Methylphenanthrene | mg/kg | 0.0004 | 0.039 | 0.081 | 0.679 | 0.111 | 0.679 | 87 | UKSHS |
| 2-Methylnaphthalene | mg/kg | 0.052 | 0.146 | 0.156 | 0.441 | 0.08 | 0.388 | 76 | Vane |
| 2-Methylphenanthrene | mg/kg | 0.0003 | 0.064 | 0.122 | 1.08 | 0.173 | 1.08 | 87 | UKSHS |
| Acenaphthene | mg/kg | 0.001 | 0.019 | 0.072 | 0.776 | 0.159 | 0.775 | 87 | UKSHS |
| Acenaphthene | mg/kg | 0.026 | 0.101 | 0.131 | 0.446 | 0.095 | 0.42 | 76 | Vane |
| Acenaphthylene | mg/kg | 0.019 | 0.073 | 0.099 | 0.397 | 0.081 | 0.378 | 76 | Vane |
| Acenapthylene | mg/kg | 0.001 | 0.034 | 0.111 | 2.47 | 0.323 | 2.469 | 87 | UKSHS |
| Anthanthrene | mg/kg | 0* | 0.134 | 0.187 | 0.817 | 0.17 | 0.817 | 76 | Vane |
| Anthracene | mg/kg | 0.0003 | 0.044 | 0.148 | 3.98 | 0.447 | 3.98 | 87 | UKSHS |
| Anthracene | mg/kg | 0.045 | 0.178 | 0.242 | 1.047 | 0.22 | 1.002 | 76 | Vane |
| Benzo[a]anthracene | mg/kg | 0.004 | 0.315 | 0.682 | 17.9 | 1.974 | 17.896 | 87 | UKSHS |
| Benzo[a]anthracene | mg/kg | 0.331 | 1.398 | 1.967 | 8.641 | 1.83 | 8.31 | 76 | Vane |
| Benzo[a]fluoranthene | mg/kg | 0* | 0.198 | 0.231 | 0.705 | 0.172 | 0.705 | 76 | Vane |
| Benzo[a]pyrene | mg/kg | 0.006 | 0.333 | 0.878 | 31.2 | 3.358 | 31.194 | 87 | UKSHS |
| Benzo[a]pyrene | mg/kg | 0.332 | 1.47 | 1.896 | 6.976 | 1.451 | 6.644 | 76 | Vane |
| Benzo[b]fluoranthene | mg/kg | 0.008 | 0.368 | 0.94 | 35.1 | 3.761 | 35.092 | 87 | UKSHS |
| Benzo[b]fluoranthene | mg/kg | 0.272 | 1.096 | 1.289 | 4.141 | 0.895 | 3.87 | 76 | Vane |
| Benzo[e]pyrene | mg/kg | 0.006 | 0.305 | 0.577 | 14 | 1.538 | 13.994 | 87 | UKSHS |
| Benzo[e]pyrene | mg/kg | 0.398 | 1.572 | 1.975 | 6.389 | 1.387 | 5.991 | 76 | Vane |
| Benzo[g,h,i]perylene | mg/kg | 0.296 | 1.251 | 1.594 | 5.979 | 1.287 | 5.684 | 76 | Vane |
| Benzo[g,h,i]perylene | mg/kg | 0.005 | 0.216 | 0.481 | 11.8 | 1.306 | 11.795 | 87 | UKSHS |
| Benzo[j]fluoranthene | mg/kg | 0.008 | 0.368 | 0.94 | 35.1 | 3.761 | 35.092 | 87 | UKSHS |
| Benzo[j]fluoranthene | mg/kg | 0.116 | 0.517 | 0.631 | 2.125 | 0.481 | 2.009 | 76 | Vane |
| Benzo[k]fluoranthene | mg/kg | 0.007 | 0.285 | 0.709 | 20.6 | 2.232 | 20.593 | 87 | UKSHS |
| Benzo[k]fluoranthene | mg/kg | 0.133 | 0.553 | 0.666 | 2.265 | 0.52 | 2.132 | 76 | Vane |
| Biphenyl | mg/kg | 0.005 | 0.023 | 0.027 | 0.086 | 0.015 | 0.081 | 76 | Vane |

| PAH | Units | Min. | Median | Mean | Max. | Std. Dev. | Range | Number | Source |
|---|---|---|---|---|---|---|---|---|---|
| C1-benzo[a]anthracene + C1-chrysene | mg/kg | 0.011 | 0.278 | 0.431 | 2.11 | 0.449 | 2.099 | 76 | Vane |
| C1-fluoranthenes + C1-pyrenes | mg/kg | 0.1 | 0.52 | 0.699 | 2.96 | 0.622 | 2.86 | 76 | Vane |
| C1-fluorenes | mg/kg | 0.029 | 0.079 | 0.091 | 0.241 | 0.046 | 0.213 | 76 | Vane |
| C1-phenanthrenes + C1-anthracenes | mg/kg | 0.103 | 0.423 | 0.56 | 2.268 | 0.431 | 2.164 | 76 | Vane |
| C2-naphthalenes | mg/kg | 0.086 | 0.313 | 0.342 | 1.104 | 0.187 | 1.018 | 76 | Vane |
| C2-phenanthrenes + C2-anthracenes | mg/kg | 0.048 | 0.376 | 0.521 | 1.874 | 0.424 | 1.826 | 76 | Vane |
| Chrysene | mg/kg | 0.306 | 1.179 | 1.514 | 5.08 | 1.149 | 4.774 | 76 | Vane |
| Chrysene | mg/kg | 0.008 | 0.417 | 0.895 | 25 | 2.722 | 24.992 | 87 | UKSHS |
| Coronene | mg/kg | 0.0001 | 0.029 | 0.116 | 2.83 | 0.336 | 2.83 | 87 | UKSHS |
| Dibenz[a,h]anthracene | mg/kg | 0.033 | 0.159 | 0.21 | 0.843 | 0.185 | 0.81 | 76 | Vane |
| Dibenzo[a,c]anthracene | mg/kg | 0.001 | 0.04 | 0.113 | 3.22 | 0.356 | 3.219 | 87 | UKSHS |
| Dibenzo[a,i]pyrene | mg/kg | 0* | 0.089 | 0.111 | 0.433 | 0.098 | 0.433 | 76 | Vane |
| Dibenzofuran | mg/kg | 0.016 | 0.061 | 0.074 | 0.236 | 0.044 | 0.22 | 76 | Vane |
| Dibenzothiophene | mg/kg | 0.02 | 0.264 | 0.262 | 0.744 | 0.179 | 0.724 | 76 | Vane |
| Fluoranthene | mg/kg | 0.011 | 0.769 | 2.786 | 139 | 14.865 | 138.989 | 87 | UKSHS |
| Fluoranthene | mg/kg | 0.569 | 2.18 | 2.851 | 12.317 | 2.608 | 11.748 | 76 | Vane |
| Fluorene | mg/kg | 0.052 | 0.144 | 0.194 | 0.921 | 0.156 | 0.87 | 76 | Vane |
| Fluorene | mg/kg | $3x10^{-5}$ | 0.023 | 0.083 | 1.38 | 0.191 | 1.38 | 87 | UKSHS |
| Indeno[1,2,3-cd]pyrene | mg/kg | 0.007 | 0.243 | 0.456 | 10.8 | 1.211 | 10.793 | 87 | UKSHS |
| Indeno[1,2,3-cd]pyrene | mg/kg | 0.266 | 1.18 | 1.568 | 6.609 | 1.395 | 6.344 | 76 | Vane |
| Naphthalene | mg/kg | 0.054 | 0.118 | 0.134 | 0.382 | 0.064 | 0.328 | 76 | Vane |
| Perylene | mg/kg | 0.002 | 0.075 | 0.17 | 4.48 | 0.492 | 4.478 | 87 | UKSHS |
| Perylene | mg/kg | 0.1 | 0.407 | 0.479 | 1.692 | 0.365 | 1.591 | 76 | Vane |
| Phenanthrene | mg/kg | 0.001 | 0.296 | 0.995 | 40.1 | 4.313 | 40.099 | 87 | UKSHS |
| Phenanthrene | mg/kg | 0.226 | 0.768 | 0.946 | 4.984 | 0.746 | 4.758 | 76 | Vane |
| Pyrene | mg/kg | 0.012 | 0.664 | 2.8 | 152 | 16.249 | 151.988 | 87 | UKSHS |
| Pyrene | mg/kg | 0.477 | 1.838 | 2.462 | 10.967 | 2.258 | 10.49 | 76 | Vane |

*Vane: summary statistics taken from Vane et al., 2014 (Note: units for the data are assumed to be µg/kg in line with the data presented in this paper, rather than mg/kg as stated in the Supplementary Material for the paper).UKSHS: Statistical values (Mean, Median, Range, Standard Deviation (Std. Dev.), Maximum (Max.) and Minimum (Min.)) were calculated using measured urban soil values presented in the UKSHS Data Package. The underlined PAHs are included in the US EPA list of 16 PAH Priority Pollutants.*
**: Minimum values of zero are as reported in the evidence.*

## 4.3 Polychlorinated Biphenyls (PCBs)

(Vane, et al., 2014) also analysed top soil samples for 7 PCB congeners, and 5 PCB homologous series. Statistical summaries of these results are presented in **Table TN09-04**.

As part of the UKSHS study soil samples collected were analysed for 26 selected PCBs (Creaser, et al., 2007a). Statistical summaries of these data are presented in **Table TN09-04**.

### Table TN09-04: Background concentrations of PCBs in urban soils

(Source: (Creaser, et al., 2007a) and (Vane, et al., 2014))

| PCB | Units | Min. | Median | Mean | Max. | Std. Dev. | Range | Number | Source |
|---|---|---|---|---|---|---|---|---|---|
| PCB 18 | µg/kg | 0.00004 | 0.024 | 0.036 | 0.184 | 0.038 | 0.184 | 87 | UKSHS |
| PCB 28 | µg/kg | 0.001 | 0.045 | 0.053 | 0.263 | 0.045 | 0.262 | 87 | UKSHS |
| PCB 28 | µg/kg | 0.1 | 0.2 | 0.866 | 38.2 | 4.431 | 38.1 | 74 | Vane |
| PCB 31 | µg/kg | 0.0004 | 0.037 | 0.049 | 0.239 | 0.041 | 0.239 | 87 | UKSHS |
| PCB 47 | µg/kg | 0.24 | 0.012 | 0.019 | 0.24 | 0.028 | 0.239 | 87 | UKSHS |
| PCB 49 | µg/kg | 0.0001 | 0.022 | 0.035 | 0.319 | 0.05 | 0.319 | 87 | UKSHS |
| PCB 51 | µg/kg | 0.0001 | 0.002 | 0.004 | 0.133 | 0.014 | 0.133 | 87 | UKSHS |
| PCB 52 | µg/kg | 0.0001 | 0.032 | 0.053 | 0.322 | 0.063 | 0.322 | 87 | UKSHS |
| PCB 52 | µg/kg | 0* | 0.5 | 3.038 | 120.1 | 14.765 | 120.1 | 74 | Vane |
| PCB 77 | µg/kg | 0.00002 | 0.016 | 0.086 | 5.25 | 0.561 | 5.25 | 87 | UKSHS |
| PCB 81 | µg/kg | 0.0001 | 0.001 | 0.003 | 0.111 | 0.012 | 0.111 | 87 | UKSHS |
| PCB 99 | µg/kg | 0.002 | 0.077 | 0.119 | 1.18 | 0.162 | 1.178 | 87 | UKSHS |
| PCB 101 | µg/kg | 0.007 | 0.138 | 0.236 | 2.73 | 0.349 | 2.723 | 87 | UKSHS |
| PCB 101 | µg/kg | 0.1 | 0.4 | 3.407 | 133.3 | 15.899 | 133.2 | 74 | Vane |
| PCB 105 | µg/kg | 0.002 | 0.074 | 0.119 | 1.05 | 0.155 | 1.048 | 87 | UKSHS |
| PCB 114 | µg/kg | 0.0003 | 0.004 | 0.012 | 0.577 | 0.062 | 0.577 | 87 | UKSHS |
| PCB 118 | µg/kg | 0.007 | 0.171 | 0.285 | 3.22 | 0.417 | 3.213 | 87 | UKSHS |
| PCB 118 | µg/kg | 0.1 | 0.1 | 2.177 | 76.5 | 9.735 | 76.4 | 74 | Vane |
| PCB 123 | µg/kg | 0.0003 | 0.006 | 0.019 | 0.495 | 0.055 | 0.495 | 87 | UKSHS |
| PCB 126 | µg/kg | 0.0002 | 0.005 | 0.008 | 0.156 | 0.018 | 0.156 | 87 | UKSHS |
| PCB 128 | µg/kg | 0.002 | 0.055 | 0.101 | 1.12 | 0.152 | 1.118 | 87 | UKSHS |
| PCB 138 | µg/kg | 0.01 | 0.267 | 0.516 | 8.22 | 0.934 | 8.21 | 87 | UKSHS |
| PCB 138 | µg/kg | 0* | 1.5 | 5.928 | 190.1 | 23.13 | 190.1 | 74 | Vane |
| PCB 153 | µg/kg | 0.021 | 0.373 | 0.591 | 9.31 | 1.036 | 9.289 | 87 | UKSHS |
| PCB 153 | µg/kg | 0.1 | 1.55 | 5.177 | 157.3 | 19.025 | 157.2 | 74 | Vane |
| PCB 156 | µg/kg | 0.001 | 0.032 | 0.06 | 0.828 | 0.097 | 0.827 | 87 | UKSHS |
| PCB 157 | µg/kg | 0.001 | 0.008 | 0.025 | 0.967 | 0.105 | 0.966 | 87 | UKSHS |
| PCB 167 | µg/kg | 0.00003 | 0.013 | 0.023 | 0.363 | 0.041 | 0.363 | 87 | UKSHS |

| PCB | Units | Min. | Median | Mean | Max. | Std. Dev. | Range | Number | Source |
|---|---|---|---|---|---|---|---|---|---|
| PCB 169 | µg/kg | 0.0001 | 0.001 | 0.007 | 0.399 | 0.043 | 0.399 | 87 | UKSHS |
| PCB 170 | µg/kg | 0.0003 | 0.12 | 0.211 | 3.11 | 0.39 | 3.11 | 87 | UKSHS |
| PCB 180 | µg/kg | 0.005 | 0.191 | 0.353 | 6.17 | 0.72 | 6.165 | 87 | UKSHS |
| PCB 180 | µg/kg | 0.1 | 0.1 | 1.458 | 35.6 | 4.382 | 35.5 | 74 | Vane |
| PCB 189 | µg/kg | 0.0002 | 0.005 | 0.023 | 1.37 | 0.146 | 1.37 | 87 | UKSHS |
| ∑7PCB | µg/kg | 1 | 5.05 | 22.051 | 751.1 | 90.433 | 750.1 | 74 | Vane |
| ∑PCB3 | µg/kg | 0* | 1 | 10.897 | 361.6 | 46.751 | 361.6 | 74 | Vane |
| ∑PCB4 | µg/kg | 0.1 | 3.4 | 16.146 | 687 | 81.436 | 686.9 | 74 | Vane |
| ∑PCB5 | µg/kg | 3.7 | 12.95 | 34.235 | 820.2 | 101.028 | 816.5 | 74 | Vane |
| ∑PCB6 | µg/kg | 1.1 | 9.1 | 32.426 | 903.6 | 108.625 | 902.5 | 74 | Vane |
| ∑PCB7 | µg/kg | 0.1 | 6.25 | 14.665 | 114.1 | 21.869 | 114 | 74 | Vane |
| Total PCB | µg/kg | 0.098 | 1.864 | 3.044 | 39.345 | 4.68 | 39.246 | 87 | UKSHS |
| Total PCB | µg/kg | 9.4 | 39 | 108.357 | 2645.9 | 322.02 | 2636.5 | 74 | Vane |

*Vane: summary statistics taken from* (Vane, et al., 2014).
*UKSHS: Statistical values (Mean, Median, Range, Standard Deviation (Std. Dev.), Maximum (Max.) and Minimum (Min.)) were calculated using measured urban soil values presented in the UKSHS Data Package.*
**: Minimum values of zero are as reported in the evidence.*
*The 'Total PCB ' quoted for the UKSHS data is the sum of the concentrations measured for the 26 individual PCB congeners, with non-detects included at the detection limit.*
*For the data from* (Vane, et al., 2014)*, the sum of five homologous series (tri, tetra, penta, hexa, hepta) are presented as '∑PCB3', ∑PC43' etc. The '∑7PCB ' is the sum of the seven individual congeners, and 'Total PCB' is the sum of tri-hepta PCBs.*

## 4.4 Dioxins and Furans

Report No. 10 in the UKSHS report series presents data on 17 polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) congeners determined in soils collected from urban sites in the UK (Creaser, et al., 2007c). The data are summarised in **Table TN09-05**.

No information has been found on the following compounds:

- polybrominated dibenzodioxins (PBDD).
- polybrominated dibenzofurans (PBDF).
- polybromochloro dibenzofurans (PXDFs).
- polybromochloro-dibenzo-p-dioxins (PXDDs).

### Table TN09-05: Background concentrations of Dioxins and Furans in urban soils

(Source: (Creaser, et al., 2007c))

| Compound | Units | Min. | Median | Mean | Max. | Std. Dev. | Range | Number | Source |
|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD | ng/kg | 0.033 | 0.349 | 0.498 | 2.910 | 0.501 | 2.877 | 87 | UKSHS |
| 1,2,3,7,8-PeCDD | ng/kg | 0.056 | 1.365 | 1.978 | 9.200 | 2.114 | 9.144 | 87 | UKSHS |
| 1,2,3,4,7,8-HxCDD | ng/kg | 0.059 | 1.560 | 2.260 | 10.300 | 2.318 | 10.241 | 87 | UKSHS |
| 1,2,3,6,7,8-HxCDD | ng/kg | 0.098 | 2.900 | 4.009 | 19.870 | 4.076 | 19.772 | 87 | UKSHS |
| 1,2,3,7,8,9-HxCDD | ng/kg | 0.106 | 2.582 | 4.077 | 21.600 | 4.410 | 21.494 | 87 | UKSHS |

| Compound | Units | Min. | Median | Mean | Max. | Std. Dev. | Range | Number | Source |
|---|---|---|---|---|---|---|---|---|---|
| 1,2,3,4,6,7,8-HpCDD | ng/kg | 0.945 | 25.200 | 38.227 | 349.800 | 46.072 | 348.855 | 87 | UKSHS |
| OCDD | ng/kg | 2.650 | 103.900 | 200.435 | 4049.000 | 446.440 | 4046.350 | 87 | UKSHS |
| 2,3,7,8-TCDF | ng/kg | 0.023 | 2.447 | 10.043 | 543.000 | 57.939 | 542.977 | 87 | UKSHS |
| 1,2,3,7,8-PeCDF | ng/kg | 0.047 | 2.759 | 3.710 | 18.100 | 3.817 | 18.053 | 87 | UKSHS |
| 2,3,4,7,8-PeCDF | ng/kg | 0.157 | 4.104 | 5.385 | 26.500 | 5.722 | 26.343 | 87 | UKSHS |
| 1,2,3,4,7,8-HxCDF | ng/kg | 0.162 | 3.570 | 5.383 | 25.600 | 5.680 | 25.438 | 87 | UKSHS |
| 1,2,3,6,7,8-HxCDF | ng/kg | 0.055 | 2.586 | 4.304 | 25.200 | 5.038 | 25.145 | 87 | UKSHS |
| 1,2,3,7,8,9-HxCDF | ng/kg | 0.048 | 1.090 | 1.814 | 11.800 | 2.117 | 11.752 | 87 | UKSHS |
| 2,3,4,6,7,8-HxCDF | ng/kg | 0.113 | 3.834 | 5.775 | 42.300 | 7.286 | 42.187 | 87 | UKSHS |
| 1,2,3,4,6,7,8-HpCDF | ng/kg | 0.515 | 24.200 | 41.604 | 515.000 | 64.211 | 514.485 | 87 | UKSHS |
| 1,2,3,4,7,8,9-HpCDF | ng/kg | 0.041 | 1.406 | 2.445 | 12.800 | 2.638 | 12.759 | 87 | UKSHS |
| OCDF | ng/kg | 0.899 | 25.990 | 39.293 | 312.000 | 48.408 | 311.101 | 87 | UKSHS |
| Total polychlorinated dibenzo-p-dioxins / furans | ng/kg | 10.798 | 226.304 | 371.240 | 4803.667 | 551.948 | 4792.869 | 87 | UKSHS |

*CDD = chlorodibenzo-p-dioxin; CDF = chlorodibenzofuran; T = tetra; Pe = penta; Hx = hexa; Hp = hepta; O = octa*

*Statistical values (Min, Median, Mean, Max and Range) were calculated using measured urban soil values presented in UKSHS Data Package.*

## 4.5 Flame Retardants

(Drage, et al., 2016) studied the concentrations of legacy and emerging flame retardants in soil samples from eight sites in the UK West Midlands. The sample sites were located on a transect through the Birmingham conurbation, in the direction of the prevailing wind, and represented locations with differing levels of urbanisation. The analytes studied comprised specific Polybrominated Diphenyl Ethers (PBDEs) and Emerging Flame Retardants (EFRs). Summaries of the data are presented in **Table TN09-06**.

Several emerging flame retardants EFRs were identified in the soil samples collected:

- 2,3,4,5-tetrabromo-bis(2-ethylhexyl) phthalate (BEH-TEBP).
- 1,2-dibromo-4-(1,2 dibromoethyl)cyclohexane (TBECH or DBE- DBCH).
- allyl 2,4,6-tribromophenyl ether (ATE).
- 2-bromoallyl 2,4,6-tribromophenyl ether (BATE).
- decabromodiphenyl ethane (DBDPE).
- dechlorane plus (DP or DDC-CO).

### Table TN09-06: Background concentrations of selected PBDEs and EFRs in urban soils

(Source: Drage et al., 2016)

| Analyte | Units | Min. | Median | Mean | Max. | Std. Dev. | Range | Number |
|---|---|---|---|---|---|---|---|---|
| BDE-28 | ng/g | 0.009 | 0.16 | 0.189 | 0.5 | 0.164 | 0.491 | 8 |
| BDE-47 | ng/g | 0.58 | 0.895 | 1.151 | 2.1 | 0.581 | 1.52 | 8 |
| BDE-99 | ng/g | 0.55 | 0.915 | 0.991 | 1.6 | 0.391 | 1.05 | 8 |
| BDE-100 | ng/g | 0.12 | 0.285 | 0.288 | 0.51 | 0.138 | 0.39 | 8 |

| Analyte | Units | Min. | Median | Mean | Max. | Std. Dev. | Range | Number |
|---|---|---|---|---|---|---|---|---|
| BDE-153 | ng/g | 0.043 | 0.165 | 0.201 | 0.44 | 0.131 | 0.397 | 8 |
| BDE-154 | ng/g | 0.034 | 0.11 | 0.319 | 1.6 | 0.526 | 1.566 | 8 |
| BDE-183 | ng/g | 0.056 | 0.18 | 0.452 | 1.6 | 0.532 | 1.544 | 8 |
| BDE-209 | ng/g | 0.94 | 7.2 | 11.068 | 45 | 14.562 | 44.06 | 8 |
| ∑PBDEs | ng/g | 2.3 | 10.2 | 14.688 | 49 | 15.153 | 46.7 | 8 |
| ∑tri-hepta PBDEs | ng/g | 1.4 | 3.95 | 3.588 | 5.8 | 1.539 | 4.4 | 8 |
| ATE | ng/g | 0.01 | 0.14 | 0.234 | 0.69 | 0.239 | 0.68 | 8 |
| ∑DDC-CO | ng/g | 0.016 | 1.95 | 1.89 | 4.5 | 1.26 | 4.484 | 8 |
| DBDPE | ng/g | 0.022 | 0.345 | 0.38 | 0.99 | 0.303 | 0.968 | 8 |

*BEH-TEBP and DBE-DBCH were not detected in soil samples and BATE was detected in only one soil sample hence statistical analysis is not possible.*

## 4.6 Normal Background Concentrations

The data presented in the preceding sections describe the distribution of contaminants in soils, as recorded during previously published soil surveys. However, the Part 2A Contaminated Land Statutory Guidance (Defra, 2012), provides a more specific definition of what defines a “normal” level of contaminants in soil that relates to its presence due to soil formation and the underlying geology and to low-level, diffuse pollution and that might be considered typical of a given area. (Johnson, et al., 2012) determined normal background concentrations (NBCs) for seven priority contaminants in soils, in accordance with the definition of “normal” in the Defra Statutory guidance. NBC were calculated for different domains within England based on geological soil parent material or mineralisation, and land use. The calculations used data from previous surveys that met specific acceptability criteria in terms of extent, sampling method and quality.

The NBC presented in (Johnson, et al., 2012) are summarised in **Table TN09-07**, below. The NBC for urban domains are higher than those for the principal (nationwide) domains (e.g. NBC for benzo[a]pyrene: principal domain = 0.5 mg/kg; urban domain = 3.6 mg/kg). This reflects the greater amount of anthropogenic pollution that might be considered typical of an urban area. The UKSHS also found that concentrations of heavy metals / metalloids, PAHs, PCBs, plus dioxins and furans, were greater in urban / industrial soils compared to rural soils ( (Ross, et al., 2007), (Creaser, et al., 2007a), (Creaser, et al., 2007b), (Creaser, et al., 2007c). Sources of diffuse, contamination in urban soils are discussed in the accompanying Technical Note TN13: Potential source contributions to urban soil pollution.

### Table TN09-07: Summary of domain normal background concentrations (NBCs)

(Source: Johnson et al., 2012)

| Analyte | Units | Principal Domain | | Urban Domain | |
|---|---|---|---|---|---|
| | | NBC | Number | NBC | Number |
| As | mg/kg | 32 | 41509 | NR | NR |
| BaP | mg/kg | 0.5 | 371 | 3.6 | 32 |
| Cd | mg/kg | 1.0 | 4418 | 2.1 | 9308 |
| Cu | mg/kg | 62 | 34504 | 190 | 7475 |
| Hg | mg/kg | 0.5 | 1126 | 1.9 | 512 |
| Ni | mg/kg | 42 | 41768 | NR | NR |

| Analyte | Units | Principal Domain | | Urban Domain | |
|---|---|---|---|---|---|
| | | NBC | Number | NBC | Number |
| Pb | mg/kg | 180 | 34257 | 820 | 7529 |

*BaP: benzo[a]pyrene*
*NBC: Normal Background Concentration*
*NR: Not reported*

## 4.7 Other Soil Properties

In addition to the contaminant data, data were obtained from the UKSHS for other soil properties that may be required when assessing the fate and transport of COPC in the environment (Copplestone, et al., 2007). These were pH and soil organic carbon content. The following statistics for pH values were calculated using data provided in the UKSHS Data Package for UK urban soil samples (**Table TN09-08**).

### Table TN09-08: Summary statistics for pH values measured in UK urban top soils

(Source: (Copplestone, et al., 2007))

| Min. | Median | Max. | Range | Number |
|---|---|---|---|---|
| 4.32 | 5.76 | 7.53 | 3.21 | 87 |

*UKSHS: Statistical values (Median, Range, Maximum (Max.) and Minimum (Min.)) were calculated using measured urban soil values presented in the UKSHS Data Package.*

Organic Carbon values were calculated using data available in the UKSHS for UK urban soil samples. Organic matter was determined by wet oxidation and loss-on-ignition methods. Organic Carbon has been calculated from measured values of organic matter. (Copplestone, et al., 2007). Calculated statistical values are presented in **Table TN09-09.**

### Table TN09-09: Summary statistics for organic matter and organic carbon values measured in UK urban top soil

(Source: (Copplestone, et al., 2007)

| Analyte | Min. | Median | Mean | Max. | Std. Dev. | Range | Number |
|---|---|---|---|---|---|---|---|
| Organic Carbon (mg/g) | 22 | 70.34 | 76.93 | 187.03 | 34.28 | 165.03 | 87 |
| Organic Matter (mg/g) | 38 | 121 | 132.33 | 322 | 58.99 | 284 | 87 |

*UKSHS: Statistical values (Mean, Median, Range, Standard Deviation (Std. Dev.), Maximum (Max.) and Minimum (Min.)) were calculated using measured urban soil values presented in the UKSHS Data Package.*

## 4.8 Other Chemicals of Potential Concern

Out of the COPC (priority chemicals) identified in the fire chemistry evidence review, based on the agreed search methods, no relevant information regarding background concentration in London or urban UK soils has been found for the following chemicals to date:

- Volatile Organic Compounds (VOCs).
- Isocyanates.
- Phosphorus compounds.
- Hydrogen cyanide.
- Asbestos.
- Synthetic vitreous fibres.
- Perfluorinated compounds.

# 5. Reference List

Copplestone, D., Wood, M., Tyler, A. & Crook, P., 2007. *UKSHS Report No. 4: Soil property and radiometric analytical methods,* Bristol: Environment Agency.

Creaser, C. et al., 2007a. *UKSHS Report No. 8: Environmental concentrations of polychlorinated biphenyls (PCBs) in UK soil and herbage,* Bristol: Environment Agency.

Creaser, C. et al., 2007b. *UKSHS Report No. 9: Environmental concentrations of polycyclic aromatic hydrocarbons in UK soil and herbage,* Bristol: Environment Agency.

Creaser, C. et al., 2007c. *UKSHS Report No. 10: Environmental concentrations of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in UK soil and herbage,* Bristol: Environment Agency.

Defra, 2012. *Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance.* London: Department for Environment, Food and Rural Affairs (Defra). HM Government.

Drage, D. et al., 2016. Concentrations of legacy and emerging flame retardants in air and soil on a transect in the UK West Midland. *Chemosphere, vol. 148 ,* pp. 195-203.

Johnson, et al., 2011. *London Earth Topsoil Chemical Results: User Guide, Open Report OR/11/035 (http://nora.nerc.ac.uk/id/eprint/14402/1/OR11035.pdf),* Nottingham: British Geological Survey.

Johnson, C., Ander, E., Cave, M. & Palumbo-Roe, B., 2012. *Normal background concentrations (NBCs) of contaminants in English soils: Final project report,* Nottingham: British Geological Survey Commissioned Report, CR/12/035.

Ross, S. et al., 2007. *UKSHS Report No. 7: Environmental concentrations of heavy metals in UK soil and herbage,* Bristol: Environment Agency.

Vane, C. et al., 2014. Polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCB) in urban soils of Greater London, UK. *Applied Geochemistry,* Volume 51, p. 303.

# Appendix TN09-A. Evidence Record - Search Summaries

## Table A. Evidence Record - Search Summaries

| Search number | Keyword(s) / word string | Date of Search | Search tool / origin or other tracing information | Hyperlink to origin (URL) | Number of search hits | Number of hits screened | Number of hits taken forward to review (Table B) |
|---|---|---|---|---|---|---|---|
| 1 | urban soil concentration | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=urban+soil+concentration | 11066 | 100 | 3 |
| 2 | urban AND soil AND concentration | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=urban+AND+soil+AND+concentration | 11066 | 100 | 3 |
| 3 | "urban" "soil" "concentration" | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=%22urban%22+%22soil%22+%22concentration%22 | 11066 | 100 | 4 |
| 4 | "soil contamination" | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=%22soil+contamination%22 | 13 | 13 | 0 |
| 5 | soil contamination | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=soil+contamination&filter_organisations%5B%5D=department-for-environment-food-rural-affairs | 3657 | 100 | 1 |
| 6 | soil contamination (Organisation = DEFRA) | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=soil+contamination&filter_organisations%5B%5D=department-for-environment-food-rural-affairs | 341 | 341 | 0 |
| 7 | soil contamination (Organisation = Environmental Agency) | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=soil+contamination&filter_organisations%5B%5D=environment-agency | 307 | 120 | 4 |
| 8 | "soil pollution" | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=%22soil+pollution%22 | 4 | 4 | 0 |
| 9 | soil pollution | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=soil+pollution | 9787 | 100 | 0 |
| 10 | "soil pollutant" | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=%22soil+pollutant%22 | 4 | 4 | 0 |
| 11 | soil pollutant | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=soil+pollutant | 4792 | 100 | 0 |
| 12 | "background level" | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=%22background+level%22 | 16 | 16 | 0 |
| 13 | background concentration | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=background+concentration | 19337 | 20* | 1 |
| 14 | "background concentration" | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=%22background+concentration%22 | 9 | 9 | 1 |
| 15 | "urban soil" | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=%22urban+soil%22 | 0 | 0 | 0 |
| 16 | soil | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=soil | 2483 | 100 | 3 |
| 17 | urban | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=urban | 4978 | 100 | 0 |
| 18 | contaminant | 09.04.2019 | GOV.UK | https://www.gov.uk/search?q=+contaminant&start=80 | 1649 | 100 | 1 |
| 19 | urban soil concentration | 09.04.2019 | Data.gov.uk (Organisation =Food and Environment research Agency) | https://data.gov.uk/search?q=urban+soil+concentration&=The+Food+and+Environment+Research+Agency&filters%5Bpublisher%5D=The+Food+and+Environment+Research+Agency&=Environment&filters%5Btopic%5D=Environment&=&filters%5Bformat%5D=&sort=best | 4 | 4 | 0 |
| 20 | urban soil concentration | 09.04.2019 | Data.gov.uk (Organisation =Centre for Environment, Fishery and Aquatic Science (Organisation = environment) | https://data.gov.uk/search?q=urban+soil+concentration&=Centre+for+Environment%2C+Fisheries+%26+Aquaculture+Science&filters%5Bpublisher%5D=Centre+for+Environment%2C+Fisheries+%26+Aquaculture+Science&=Environment&filters%5Btopic%5D=Environment&=&filters%5Bformat%5D=&sort=best | 29 | 29 | 0 |
| 21 | urban soil concentration | 09.04.2019 | Data.gov.uk (Organisation = Centre for Environmental Data) | https://data.gov.uk/search?q=urban+soil+concentration+&=Centre+for+Environmental+Data+Analysis&filters%5Bpublisher%5D=Centre+for+Environmental+Data+Analysis&=Environment&filters%5Btopic%5D=Environment&=&filters%5Bformat%5D=&sort=best | 16 | 16 | 0 |
| 22 | urban soil concentration | 09.04.2019 | Data.gov (Organisation = Coal Authority, Topic= Environment) | https://data.gov.uk/search?q=urban+soil+concentration&=Coal+Authority&filters%5Bpublisher%5D=Coal+Authority&=Environment&filters%5Btopic%5D=Environment&=&filters%5Bformat%5D=&sort=best | 1 | 1 | 1 |
| 23 | urban soil concentration | 09.04.2019 | Data.gov (Organisation = Cranfield University, Topic= Environment) | https://data.gov.uk/search?q=urban+soil+concentration&=Cranfield+University&filters%5Bpublisher%5D=Cranfield+University&=Environment&filters%5Btopic%5D=Environment&=&filters%5Bformat%5D=&sort=best | 62 | 62 | 2 |
| 24 | urban soil concentration | 09.04.2019 | Data.gov.uk | https://data.gov.uk/search?q=urban+soil+concentration | 8315 | 100 | 5 |
| 25 | soil contamination | 09.04.2019 | Data.gov.uk | https://data.gov.uk/search?q=soil+contamination&=&filters%5Bpublisher%5D=&=&filters%5Btopic%5D=&=&filters%5Bformat%5D=&sort=best | 7494 | 100 | 0 |
| 26 | soil pollution | 09.04.2019 | Data.gov.uk | https://data.gov.uk/search?q=soil+pollution | 7692 | 100 | 2 |
| 27 | soil pollutant | 09.04.2019 | Data.gov.uk | https://data.gov.uk/search?q=soil+pollutant&=&filters%5Bpublisher%5D=&=&filters%5Btopic%5D=&=&filters%5Bformat%5D=&sort=best | 7692 | 100 | 2 |
| 28 | background level | 09.04.2019 | Data.gov.uk | https://data.gov.uk/search?q=background+level&=&filters%5Bpublisher%5D=&=&filters%5Btopic%5D=&=&filters%5Bformat%5D=&sort=best | 9853 | 100 | 0 |
| 29 | background concentration | 09.04.2019 | Data.gov.uk | https://data.gov.uk/search?q=background+concentration&=&filters%5Bpublisher%5D=&=&filters%5Btopic%5D=&=&filters%5Bformat%5D=&sort=best | 500 | 100 | 3 |
| 30 | urban soil | 09.04.2019 | Data.gov.uk | https://data.gov.uk/search?q=urban+soil&=&filters%5Bpublisher%5D=&=&filters%5Btopic%5D=&=&filters%5Bformat%5D=&sort=best | 8047 | 100 | 4 |

## Table A. Evidence Record - Search Summaries

| Search number | Keyword(s) / word string | Date of Search | Search tool / origin or other tracing information | Hyperlink to origin (URL) | Number of search hits | Number of hits screened | Number of hits taken forward to review (Table B) |
|---|---|---|---|---|---|---|---|
| 31 | urban AND soil AND pollutant AND contaminant AND concentration AND background | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0%2C5&q=urban+AND+soil+AND+pollutant+AND+contaminant+AND+concentration+AND+background&btnG= | 43200 | 100 | 1 |
| 32 | urban AND soil AND pollutant AND contaminant AND concentration AND background AND United Kingdom | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0%2C5&q=urban+AND+soil+AND+pollutant+AND+contaminant+AND+concentration+AND+background+AND+united+kingdom&btnG= | 24600 | 100 | 3 |
| 33 | urban+soil+pollutant+contaminant+concentration +background+London | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0%2C5&q=urban%2Bsoil%2Bpollutant%2Bcontaminant%2Bconcentration%2Bbackground%2BLondon&btnG= | 25800 | 100 | 7 |
| 34 | metal+urban soil+ United Kingdom; after 2000 | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0,5&q=metal%2Burban+soil%2B+United+Kingdom | 18900 | 40 | 0 |
| 35 | heavy metal urban soil contamination AND london | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?start=20&q=%22heavy+metal%22+urban+soil+contamination+AND+london&hl=en&as_sdt=0,5&as_ylo=2000 | 17900 | 60 | 0 |
| 36 | (hydrocarbon OR Organic) AND urban soil AND United Kingdom -China ; after 2000 | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0%2C5&as_ylo=2000&q=%28hydrocarbon+OR+Organic%29+AND+urban+soil+AND+United+Kingdom+-China&btnG= | 24300 | 100 | 2 |
| 37 | allintitle: metal AND soil contamination AND urban; post 2000 | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0%2C5&as_ylo=2000&q=allintitle%3A+metal+AND+soil+contamination+AND+urban+&btnG= | 34 | 34 | 4 |
| 38 | allintitle: hydrocarbon AND soil AND urban; post 2000 | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0%2C5&as_ylo=2000&q=allintitle%3A+hydrocarbon+AND+soil+AND+urban+&btnG= | 3 | 3 | 0 |
| 39 | allintitle: organic pollutant AND soil AND urban, post 2000 | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0%2C5&as_ylo=2000&q=allintitle%3A+organic+pollutant+AND+soil+AND+urban+&btnG= | 0 | 0 | 0 |
| 40 | allintitle: soil quality AND urban; post 2000 | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?start=20&q=allintitle:+soil+quality+AND+urban+&hl=en&as_sdt=0,5&as_ylo=2000 | 113 | 40* | 0 |
| 41 | soil quality AND urban AND Britain, post 2000 | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0%2C5&as_ylo=2000&q=soil+quality+AND+urban++AND+Britain&btnG= | 109000 | 40* | 1 |
| 42 | urban AND soil AND pollutant AND contaminant AND concentration AND background; post 2000 | 10.04.2019 | PubMed | https://www.ncbi.nlm.nih.gov/pubmed/23583985 | 5 | 5 | 1 |
| 43 | urban AND soil AND pollutant AND contaminant AND concentration AND background AND United Kingdom | 10.04.2019 | PubMed | https://www.ncbi.nlm.nih.gov/pubmed?term=((urban%20AND%20soil%20AND%20pollutant%20AND%20contaminant%20AND%20concentration%20AND%20background%20AND%20United%20Kingdom))%20AND%20(%222000%22%5BDate%20-%20Publication%5D%20%3A%20%223000%22%5BDate%20-%20Publication%5D) | 2 | 2 | 1 |
| 44 | urban AND soil AND pollutant AND contaminant AND concentration AND background AND London | 10.04.2019 | PubMed | https://www.ncbi.nlm.nih.gov/pubmed?term=(urban%20AND%20soil%20AND%20pollutant%20AND%20contaminant%20AND%20concentration%20AND%20background%20AND%20London%20))%20AND%20(%222000%22%5BDate%20-%20Publication%5D%20%3A%20%223000%22%5BDate%20-%20Publication%5D)) | 1 | 1 | 0 |
| 45 | metal AND urban soil AND United Kingdom, post 2000 | 10.04.2019 | PubMed | https://www.ncbi.nlm.nih.gov/pubmed?term=((metal%20AND%20urban%20soil%20AND%20United%20Kingdom))%20AND%20(%222000%22%5BDate%20-%20Publication%5D%20%3A%20%223000%22%5BDate%20-%20Publication%5D) | 56 | 56 | 1 |
| 46 | (hydrocarbon OR Organic) AND urban soil AND United Kingdom post 2000 | 10.04.2019 | PubMed | https://www.ncbi.nlm.nih.gov/pubmed?term=(((hydrocarbon%20OR%20Organic)%20AND%20urban%20soil%20AND%20United%20Kingdom))%20AND%20(%222000%22%5BDate%20-%20Publication%5D%20%3A%20%223000%22%5BDate%20-%20Publication%5D) | 47 | 47 | 4 |
| 47 | soil quality AND urban AND Britain, post 2000 | 10.04.2019 | PubMed | https://www.ncbi.nlm.nih.gov/pubmed?term=(((soil%20qualty)%20AND%20urban)%20AND%20Britain)%20AND%20(%222000%22%5BDate%20-%20Publication%5D%20%3A%20%223000%22%5BDate%20-%20Publication%5D) | 1 | 1 | 0 |
| 48 | urban AND soil AND pollutant AND contaminant AND concentration AND background | 10.04.2019 | ResearchGate | https://www.researchgate.net/search.Search.html?type=publication&query=urban%20AND%20soil%20AND%20pollutant%20AND%20contaminant%20AND%20concentration%20AND%20background | 0 | 0 | 0 |
| 49 | urban AND soil AND pollutant AND concentration | 10.04.2019 | ResearchGate | https://www.researchgate.net/search.Search.html?type=publication&query=urban%20AND%20soil%20AND%20pollutant%20AND%20concentration | ? | 20* | 1 |
| 50 | metal AND Urban soil | 10.04.2019 | ResearchGate | https://www.researchgate.net/search.Search.html?type=publication&query=metal%20AND%20Urban%20soil | ? | 20* | 0 |
| 51 | metal AND Urban soil AND Britain | 10.04.2019 | ResearchGate | https://www.researchgate.net/search.Search.html?type=publication&query=metal%20AND%20Urban%20soil | 3 | 3 | 0 |
| 52 | metal AND Urban AND soil AND britain | 10.04.2019 | ResearchGate | https://www.researchgate.net/search.Search.html?type=publication&query=metal%20AND%20Urban%20AND%20soil%20AND%20britain | 3 | 3 | 0 |
| 53 | urban AND soil AND United Kingdom | 10.04.2019 | ResearchGate | https://www.researchgate.net/search.Search.html?type=publication&query=urban%20AND%20soil%20AND%20United%20Kingdom | ? | 30 | 3 |
| 54 | soil AND health AND background AND urban author:Bramwell, post 2000 | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0%2C5&as_ylo=2000&q=soil+AND+health+AND+background+AND+urban+author%3ABramwell&btnG= | 14 | 14 | 0 |

## Table A. Evidence Record - Search Summaries

| Search number | Keyword(s) / word string | Date of Search | Search tool / origin or other tracing information | Hyperlink to origin (URL) | Number of search hits | Number of hits screened | Number of hits taken forward to review (Table B) |
|---|---|---|---|---|---|---|---|
| 55 | soil AND urban author:Bramwell, post 2000 | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?start=20&q=soil++AND+urban+author:Bramwell&hl=en&as_sdt=0,5&as_ylo=2000 | 26 | 26 | 0 |
| 56 | Lindsay Bramwell | 10.04.2019 | ResearchGate | https://www.researchgate.net/profile/Lindsay_Bramwell/publications | 9 | 9 | 0 |
| 57 | soil AND background AND contaminant author:Anders, post 2000 | 10.04.2019 | Scholar.Google.co.uk | https://scholar.google.co.uk/scholar?hl=en&as_sdt=0%2C5&as_ylo=2000&q=soil++AND+background+AND+contaminant+author%3AAnders&btnG= | 546 | 40* | 0 |
| 58 | E. L. Ander | 10.04.2019 | ResearchGate | https://www.researchgate.net/search.Search.html?type=researcher&query=E.%20L.%20Ander | 2 | 2 | 0 |
| 59 | Urban and soil by BGS | 10.04.2019 | NERC | http://nora.nerc.ac.uk/cgi/search/archive/advanced?screen=Search&dataset=archive&_action_search=Search&creators_editors_merge=ALL&creators_editors=&creators_name_merge=ALL&creators_name=&title_merge=ALL&title=urban+AND+soil++AND&date=&id_number=&publication_merge=ALL&publication=&series_merge=ALL&series=&divisions=bgs&divisions_merge=ANY&refereed=EITHER&documents_merge=ALL&documents=&keywords_merge=ALL&keywords=&abstract_merge=ALL&abstract=&subjects_merge=ANY&rod_collaborations_merge=ANY&affiliations_merge=ALL&affiliations=&sections_merge=ANY&grant_nos_merge=ALL&grant_nos=&projects_merge=ALL&projects=&programmes_merge=ANY&gtr_progs_merge=ANY&res_grps_merge=ANY&department_merge=ALL&department=&lastmod=&datestamp=&satisfyall=ALL&order=title%2Fcreators_name%2F-date | 34 | 34 | 8 |
| 60 | Urban and soil by CEH | 10.04.2019 | NERC | http://nora.nerc.ac.uk/cgi/search/archive/advanced?screen=Search&dataset=archive&_action_search=Search&creators_editors_merge=ALL&creators_editors=&creators_name_merge=ALL&creators_name=&title_merge=ALL&title=urban+AND+soil&date=&id_number=&publication_merge=ALL&publication=&series_merge=ALL&series=&divisions=ceh&divisions_merge=ANY&refereed=EITHER&documents_merge=ALL&documents=&keywords_merge=ALL&keywords=&abstract_merge=ALL&abstract=&subjects_merge=ANY&rod_collaborations_merge=ANY&affiliations_merge=ALL&affiliations=&sections_merge=ANY&grant_nos_merge=ALL&grant_nos=&projects_merge=ALL&projects=&programmes_merge=ANY&gtr_progs_merge=ANY&res_grps_merge=ANY&department_merge=ALL&department=&lastmod=&datestamp=&satisfyall=ALL&order=title%2Fcreators_name%2F-date | 2 | 2 | 0 |
| 61 | London AND soil by BGS | 11.04.2019 | NERC | http://nora.nerc.ac.uk/cgi/search/archive/advanced?screen=Search&dataset=archive&creators_editors_merge=ALL&creators_editors=&creators_name_merge=ALL&creators_name=&title_merge=ALL&title=London+AND+soil&date=&id_number=&publication_merge=ALL&publication=&series_merge=ALL&series=&divisions=bgs&divisions_merge=ANY&refereed=EITHER&documents_merge=ALL&documents=&keywords_merge=ALL&keywords=&abstract_merge=ALL&abstract=&subjects_merge=ANY&rod_collaborations_merge=ANY&affiliations_merge=ALL&affiliations=&sections_merge=ANY&grant_nos_merge=ALL&grant_nos=&projects_merge=ALL&projects=&programmes_merge=ANY&gtr_progs_merge=ANY&res_grps_merge=ANY&department_merge=ALL&department=&lastmod=&datestamp=&satisfyall=ALL&order=-date%2Fcreators_name%2Ftitle&_action_search=Search | 11 | 11 | 5 |
| 62 | London AND soil by CEH | 11.04.2019 | NERC | http://nora.nerc.ac.uk/cgi/search/archive/advanced?screen=Search&dataset=archive&_action_search=Search&creators_editors_merge=ALL&creators_editors=&creators_name_merge=ALL&creators_name=&title_merge=ALL&title=London+AND+soil&date=&id_number=&publication_merge=ALL&publication=&series_merge=ALL&series=&divisions=ceh&divisions_merge=ANY&refereed=EITHER&documents_merge=ALL&documents=&keywords_merge=ALL&keywords=&abstract_merge=ALL&abstract=&subjects_merge=ANY&rod_collaborations_merge=ANY&affiliations_merge=ALL&affiliations=&sections_merge=ANY&grant_nos_merge=ALL&grant_nos=&projects_merge=ALL&projects=&programmes_merge=ANY&gtr_progs_merge=ANY&res_grps_merge=ANY&department_merge=ALL&department=&lastmod=&datestamp=&satisfyall=ALL&order=-date%2Fcreators_name%2Ftitle | 1 | 1 | 0 |
| 63 | London AND soil by Swindon Office | 11.04.2019 | NERC | http://nora.nerc.ac.uk/cgi/search/archive/advanced?screen=Search&dataset=archive&_action_search=Search&creators_editors_merge=ALL&creators_editors=&creators_name_merge=ALL&creators_name=&title_merge=ALL&title=London+AND+soil&date=&id_number=&publication_merge=ALL&publication=&series_merge=ALL&series=&divisions=so&divisions_merge=ANY&refereed=EITHER&documents_merge=ALL&documents=&keywords_merge=ALL&keywords=&abstract_merge=ALL&abstract=&subjects_merge=ANY&rod_collaborations_merge=ANY&affiliations_merge=ALL&affiliations=&sections_merge=ANY&grant_nos_merge=ALL&grant_nos=&projects_merge=ALL&projects=&programmes_merge=ANY&gtr_progs_merge=ANY&res_grps_merge=ANY&department_merge=ALL&department=&lastmod=&datestamp=&satisfyall=ALL&order=-date%2Fcreators_name%2Ftitle | 0 | 0 | 0 |
| 64 | Mark Cave, BGS, soil and UK and urban | 11.04.2019 | ResearchGate | https://www.researchgate.net/profile/Mark_Cave/publications | 9 | 9 | 6 |

## Table A. Evidence Record - Search Summaries

| Search number | Keyword(s) / word string | Date of Search | Search tool / origin or other tracing information | Hyperlink to origin (URL) | Number of search hits | Number of hits screened | Number of hits taken forward to review (Table B) |
|---|---|---|---|---|---|---|---|
| 65 | London Earth (Organisation = British Geological Survey) | 11.04.2019 | NERC | http://nora.nerc.ac.uk/cgi/search/archive/advanced?screen=Search&dataset=archive&_action_search=Search&creators_editors_merge=ALL&creators_editors=&creators_name_merge=ALL&creators_name=&title_merge=ALL&title=London+Earth&date=&id_number=&publication_merge=ALL&publication=&series_merge=ALL&series=&divisions=bgs&divisions_merge=ANY&refereed=EITHER&documents_merge=ALL&documents=&keywords_merge=ALL&keywords=&abstract_merge=ALL&abstract=&subjects_merge=ANY&rod_collaborations_merge=ANY&affiliations_merge=ALL&affiliations=&sections_merge=ANY&grant_nos_merge=ALL&grant_nos=&projects_merge=ALL&projects=&programmes_merge=ANY&gtr_progs_merge=ANY&res_grps_merge=ANY&department_merge=ALL&department=&lastmod=&datestamp=&satisfyall=ALL&order=-date%2Fcreators_name%2Ftitle | | 7 | 7 | 2 |

# Appendix TN09-B. Evidence Record - Summary of Evidence Identified

## B. Evidence Record - Summary of Evidence

| Evidence Number | Evidence Reference | Evidence hyperlink (if available) | Evidence Type | Corresponding search number | Taken forward | Reason for rejection | Brief summary of evidence available from source number |
|---|---|---|---|---|---|---|---|
| 1 | Environment Agency,2015, Contaminated land exposure assessment (CLEA) tool | https://www.gov.uk/government/publications/contaminated-land-exposure-assessment-clea-tool | Publication | 1,2,3,5,7 | No | Software guidance | Handbook and software to help assess the risks of contaminated land exposure for human health. |
| 2 | Environment Agency, 2007, UK soil and herbage pollutant survey (UKSHS) | https://www.gov.uk/government/publications/uk-soil-and-herbage-pollutant-survey | Publication | 1,2,3,7 | Yes | The relevant chapters referenced in sources: Evidence Number 37 to 40 | Comprises a series of reports presentinng the first national survey of soil quality and contaminant levels in soil and herbage in England, Scotland, Wales and Northern Ireland. The survey presents information about a range of pollutants comprising PCBs, dioxins, polycyclic aromatic hydrocarbons and trace metals in samples of soils and herbage taken from 122 rural, 28 urban and 50 industrial locations. |
| 3 | Environment Agency, 2006, The development and use of soil quality indicators for assessing the role of soil in environmental interactions | https://www.gov.uk/government/publications/the-development-and-use-of-soil-quality-indicators-for-assessing-the-role-of-soil-in-environmental-interactions | Publication | 7 | No | Process guidance, no soil contamination values | This report provides a processes to select and use indicators of soil quality for the function of environmental interaction. |
| 4 | Environment Agency, 2008, Ambient background metal concentrations for soils in England and Wales | https://www.gov.uk/government/publications/ambient-background-metal-concentrations-for-soils-in-england-and-wales | Publication | 1,2,3,7,13,17 | No | Data utilised pre-dates search criteria, and thus outside of scope of current review | The study investigates whether ambient background concentrations of Cd, Co, Cr, Cu, Ni, Pb and Zn in soils can be predicted from other semi-conservative soil properties such as Al and Fe concentrations or soil texture information. Data were taken from 6,000 soil samples collected between 1978 and 1983 for the National Soil Inventory (NSI) for England and Wales. |
| 5 | Environment Agency, 2009, Land contamination: using soil guideline values (SGVs) | https://www.gov.uk/government/publications/contaminated-soil-assessing-risks-on-human-health | Publication | 3,18 | No | Guidance document, no reported background concentrations | Guidance explaining the use of soil guideline values (SGV) to asses the long-term exposure of chemicals in soil on human health. |
| 6 | The Coal Authority, 2016, Environmental Monitoring Points | https://data.gov.uk/dataset/ac561055-3bac-4dd4-9e30-3f66bbc2896a/environmental-monitoring-points | Publication | 22 | No | No mention of contamination or soil quality | Monitoring point Dataset: Environmental monitoring points consist of a variety of sites throughout the UK at which environmental data are gathered by The Coal Authority. The types of data collected include: water level, mine gas concentration, flow rate, chemistry and pumping data. |
| 7 | Cranfield University, 2013, NATMAP-National Soil Map | https://data.gov.uk/dataset/ea1442bf-ba77-42cc-80e7-2ea339ccb28a/natmap-national-soil-map | Data set | 23,26,27 | No | National soil type map. Does not provide data on background concentrations of COPC | NATMAP is a vector dataset and is the most detailed of four versions of the National Soil Map and is the product of sixty years of soil survey work in England and Wales. |
| 8 | British Geological Survey, 2018, Estimated Urban Soil Chemistry | https://data.gov.uk/dataset/6b6d2aab-4b5b-46bc-9105-a71169bab449/estimated-urban-soil-chemistry | Data set | 24,27,30 | No | Relevant G-BASE data are summarised in record Evidence Number 42 | The Estimated Urban Soil Chemistry data are derived by spatial interpolation of the Measured Urban Soil Chemistry data. They include estimated bioaccessible arsenic and lead data. The Estimated Urban Soil Chemistry data indicates the estimated geometric mean concentrations (as mg/kg) of Arsenic, Cadmium, Chromium, Nickel and Lead in topsoil. |
| 9 | British Geological Survey, 2018, Measured Urban Soil Chemistry | https://data.gov.uk/dataset/f9e2cbb1-8aba-4797-9888-368d102a7ddc/measured-urban-soil-chemistry | Data set | 24,26,27,30 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | BGS digital Measured Urban Soil Chemistry data comprises the locations and concentrations (mg/kg) of Arsenic (As), Cadmium (Cd), Chromium (Cr), Nickel (Ni) and Lead (Pb) in urban topsoil samples. The data is derived from the national, high resolution urban soil geochemical data from the BGS Geochemical Baseline Survey of the Environment (G-BASE) project. |
| 10 | Natural radionuclide concentrations in soil, water, sediment and biota in England and Wales | https://data.gov.uk/search?q=urban+soil+concentration | Data set | 24 | No | Radionuclides are not relevant COPC | Data comprise estimates of activity concentrations of naturally occurring radionuclides (40K, 238U and 232Th series radionuclides) in environmental media (soil and stream sediments and waters). |
| 11 | Map based index (GeoIndex) urban geochemical reports | https://data.gov.uk/dataset/cfc1b41b-10e5-40a5-ae14-0b6cbad00e3a/map-based-index-geoindex-urban-geochemical-reports | Data set | 24,29 | No | Provides an index only, not access to individual reports. | Geoindex layer that displays urban areas for which there is an "urban geochemical mapping" report. |
| 12 | Normal background concentrations of contaminants (OGC WxS INSPIRE) | https://data.gov.uk/dataset/84275b63-fa12-476b-a949-43cacca8f646/normal-background-concentrations-of-contaminants-ogc-wxs-inspire | Data set | 29 | No | Unable to access data or WMS to assess further | WMS dataset for BGS Normal background concentrations of contaminants. |
| 13 | Estimated Ambient Background Soil Chemistry England and Wales | https://data.gov.uk/dataset/278d857f-400c-414c-8a9c-71db9e77cb79/estimated-ambient-background-soil-chemistry-england-and-wales | Data set | 29 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | The Estimated Ambient Background Soil Chemistry England and Wales dataset indicates the estimated geometric mean topsoil Arsenic(As), Cadmium (Cd), Cr (Chromium), Nickel (Ni) and Lead (Pb) concentrations (reported as mg/kg). The soil chemistry data is based on GBASE (Geochemical Baseline Survey of the Environment) soil geochemical data where these are available. |
| 14 | Estimated Urban Soil Chemistry Great Britain (version1) | https://data.gov.uk/dataset/3cd0a62f-6fd1-4ad1-8cd6-7c3e6c3bc9dc/estimated-urban-soil-chemistry-great-britain-version-1 | Data set | 30 | No | Relevant G-BASE data are summarised in record Evidence Number 42 | BGS digital estimated urban soil chemistry data (GBEstimatedUrbanSoilChemistryv3) indicates the estimated geometric mean concentrations (mg/kg) of Arsenic (As), Cadmium (Cd), Chromium (Cr), Nickel (Ni) and Lead (Pb) in topsoil derived by spatial interpolation of the point source urban soil chemistry data. The original urban topsoil samples were collected and analysed as part of the BGS Geochemical Baseline Survey of the Environment (G-BASE) project. |
| 15 | Geochemical Baseline Survey Of The Environment (G-BASE) For UK Soils In Urban Areas. | https://data.gov.uk/dataset/e04467e2-3c5b-4856-b805-1666f379d103/geochemical-baseline-survey-of-the-environment-g-base-for-uk-soils-in-urban-areas | Data set | 24,30 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | Soil samples collected in urban areas throughout the UK are analysed for their major and trace element geochemistry, their pH and organic matter content. Samples are collected at two depths; 0-15 cm and 35-45 cm at sites selected using a stratified, random design. The data can be used to identify and prioritize contaminated sites. In 1993, the Geochemical Baseline Survey Of The Environ (G-BASE) rural geochemical mapping programme |

## B. Evidence Record - Summary of Evidence

| Evidence Number | Evidence Reference | Evidence hyperlink (if available) | Evidence Type | Corresponding search number | Taken forward | Reason for rejection | Brief summary of evidence available from source number |
|---|---|---|---|---|---|---|---|
| 16 | Johnson et al., 2012, Normal background concentrations (NBCs) of contaminants in English soils: final project report | http://nora.nerc.ac.uk/id/eprint/19946/ | Publication | 31,33 | Yes | G-BASE and NSI data (latter pre-2000), mentions asbestos but no values reported due to insufficient data. | The British Geological Survey (BGS) was commissioned by the Department for Environment, Food and Rural Affairs (Defra) to advise on what are normal levels of contaminants in English soils in support of the Part 2A Contaminated Land Statutory Guidance. This was initially done by studying the distribution of four contaminants in top soils from England (arsenic, lead, benzo[a]pyrene (BaP) and asbestos). This was then extended to a another four contaminants (cadmium, copper, nickel and mercury) which allowed methodologies to be tested on a larger range of contaminants. The project gathered data sets that were nationally extensive, systematically collected (so a broad range of land uses were represented) and collected and analysed to demonstrable and acceptable levels of quality. |
| 17 | Ander et al., 2013, Methodology for the determination of normal background concentrations of contaminants in English soil | https://www.sciencedirect.com/science/article/pii/S0048969713002878 | Publication | 31,32,33,42,43 | No | Only methodology | Available soil data sets for England are explored for inorganic contaminants (As, Cd, Cu, Hg, Ni and Pb) and benzo[a]pyrene (BaP). Spatial variability of contaminants is studied in the context of the underlying parent material, metalliferous mineralisation and associated mining activities, and the built (urban) environment, the latter being indicative of human activities such as industry and transportation. |
| 18 | Vane et al., 2014, Polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCB) in urban soils of Greater London, UK | https://www.sciencedirect.com/science/article/pii/S0883292714002248 | Publication | 32,33,61 | Yes | | Surface soils were collected from a 19 $km^2$ area in east London. The samples were analysed for polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCB). Normal background concentrations of polycyclic aromatic hydrocarbons and polychlorinated biphenyls are elevated in east London soils and in some cases exceed regulatory assessment criteria. |
| 19 | Fordyce et al., 2005 GSUE: urban geochemical mapping in Great Britain | https://geea.lyellcollection.org/content/5/4/325.short | Publication | 32,33,36,41 | No | Provides an overview of methodology and use of data. | The British Geological Survey is responsible for the national strategic geochemical survey of Great Britain. As part of this programme, the Geochemical Surveys of Urban Environments (GSUE) project was initiated in 1992 and to date, 21 cities have been mapped. Urban sampling is based upon the collection of top (0.05 to 0.20 m) and deeper (0.35 to 0.50 m) soil samples on a 500 m grid across the built environment (one sample per 0.25 $km^2$). Samples are analysed for c. 46 total element concentrations by X-ray fluorescence spectrometry, pH and loss on ignition as an indicator of organic matter content. The data provide an overview of the urban geochemical signature and because they are collected as part of a national baseline programme, can be readily compared with soils in rural areas to assess the extent of urban contamination. The data are of direct relevance to current UK land use planning, urban regeneration and contaminated land legislative regimes. An overview of the project and applications of the data to human health risk assessment, water quality protection and contaminant source identification are presented. |
| 20 | Rothwell, Cooke, 2015, A comparison of methods used to calculate normal background concentrations of potentially toxic elements for urban soil | https://www.sciencedirect.com/science/article/pii/S0048969715302783 | Publication | 33 | No | No systematically collected data | This study aims to calculate NBC levels for Gateshead, an urban Metropolitan Borough in the North East of England, using freely available data. |
| 21 | Saltiene et al., 2010, Contamination of Soil by Polycyclic Aromatic Hydrocarbons in Some Urban Areas | https://www.tandfonline.com/doi/abs/10.1080/10406630210371 | Publication | 33 | No | Only 3 data points for London, too few to include | The contamination by 16 polycyclic aromatic hydrocarbons (PAHs) in surface soils, sampled at a 0-5 cm depth in the urban areas of Tallinn, Helsinki, Vilnius, Chicago, London is reported. |
| 22 | Bradley et al., 2005, A soil carbon and land use database for the United Kingdom | https://onlinelibrary.wiley.com/doi/pdf/10.1079/SUM2005351 | Publication | 36 | No | Not relevant | The compilation of a database of soil carbon and land use is described, from which models of soil carbon dioxide emissions across the United Kingdom (UK) can be run. The database gives soil organic carbon, sand, silt and clay contents and bulk densities weighted to reference layers from 0 to 30 cm and from 30 to 100 cm depths. The data are interpolated from information on soil types and land use on a 1 km grid across the UK and are used to estimate soil carbon stocks. |
| 23 | Appleton, et al., 2012 Modelling lead bioaccessibility in urban top soils based on data from Glasgow, London, Northampton and Swansea, UK | https://www.ncbi.nlm.nih.gov/pubmed/22938825 | Publication | 45 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | Predictive linear regression (LR) modelling between bioaccessible arsenic (B-As) and a range of total elemental compositions and soil properties was conducted to assess the potential to develop a national dataset for the UK. LR indicates that total arsenic (As) is the only highly significant independent variable for estimating B-As in urban areas where it explains 75-92% of the variance. The broad compatibility of the London, Glasgow and Swansea regression models suggests that application of these models to estimate bioaccessible As in UK soils impacted by diffuse anthropogenic urban contamination and non-ferrous metal processing should be relatively accurate. In areas dominated by Jurassic ironstones and associated clays and limestones, total As, P and pH are significant, accounting for 53, 14 and 5%, respectively, of the B-As variance. Models based on total As the sole predictor in the combined Jurassic and Cretaceous sedimentary ironstones datasets explain about 40% of the B-As variance. The median As bioaccessible fraction (%As-BAF) is 19 to 28% in the anthropogenic contamination impacted urban domains, but much lower (5-9%) in geogenic terrains dominated by ironstones. Results of this study can be used as part of a lines of evidence approach to localised risk assessment but should not be used to replace bioaccessibility testing at individual sites where local conditions may vary considerably from the broad overview presented in this study. |
| 24 | Krauss, Wilcke, 2003, Polychlorinated naphthalenes in urban soils: Analysis, concentrations, and relation to other persistent organic pollutants | https://www.researchgate.net/publication/10943209_Polychlorinated_naphthalenes_in_urban_soils_Analysis_concentrations_and_relation_to_other_persistent_organic_pollutants | Publication | 49 | No | Only presents data for German cities, and thus outside of scope of current review | Measured concentrations of 35 PCNs, 12 PCBs, and 20 PAHs in 49 urban top soils under different land use (house garden, roadside grassland, alluvial grassland, park areas, industrial sites, agricultural sites) and in nine rural top soils. Unknown location. |

## B. Evidence Record - Summary of Evidence

| Evidence Number | Evidence Reference | Evidence hyperlink (if available) | Evidence Type | Corresponding search number | Taken forward | Reason for rejection | Brief summary of evidence available from source number |
|---|---|---|---|---|---|---|---|
| 25 | Tipping et al., 2011, Mercury in United Kingdom top soils; Concentrations, pools, and Critical Limit exceedances | https://www.researchgate.net/search.Search.html?type=publication&query=urban%20AND%20soil%20AND%20United%20Kingdom | Publication | 53 | No | Rural samples, not urban contamination, and thus outside of scope of current review | The median total mercury concentration in 898 UK rural top soils, sampled between 1998 and 2008. The highest concentrations were in the north and west, where organic-rich soils with low bulk densities dominate, but the spatial pattern was quite different if soil Hg pools (mg m(-2)) were considered, the highest values being near to the industrial north of England and London. Possible toxic effects of Hg were best evaluated by comparison with soil Critical Limits expressed as ratios of Hg to soil organic matter, or soil solution Hg(2+) concentrations, estimated by chemical speciation modelling. Only a few percent of the rural UK soils showed exceedance, and this also applied to rural soils from the whole of Europe. UK urban and industrial soils had higher Hg concentrations and more cases of exceedance. |
| 26 | Lark, C. Scheib, 2013, Land use and lead content in the soils of London | https://www.researchgate.net/publication/263282850_Land_use_and_lead_content_in_the_soils_of_London | Publication | 64,53,61 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | Study on the lead content from the topsoil of the Greater London Area (GLA) in the United Kingdom. |
| 27 | Rowbotham, Levy, Shuker, 2000, Chromium in the environment: An evaluation of exposure of the UK general population and possible adverse health effects | https://www.researchgate.net/publication/12407800_Chromium_in_the_environment_An_evaluation_of_exposure_of_the_UK_general_population_and_possible_adverse_health_effects | Publication | 53 | No | Only relevant to exposure calculation | This review summarizes the available exposure data and known health effects of Chromium and evaluates the potential risk to human health in the United Kingdom. |
| 28 | Wragg, Cave, 2012, Assessing the link between the Geochemistry of Soils and the Bioaccessibility of Arsenic, Chromium and Lead in the Urban Environment. | http://nora.nerc.ac.uk/id/eprint/18976/ | Publication | 64 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | A geochemical survey of the soils of Northampton. |
| 29 | Flight et al., 2011, Soil geochemical baselines in UK urban centres : The G-BASE Project. | http://nora.nerc.ac.uk/id/eprint/14028/ | Publication | 59 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | The British Geological Survey's Geochemical Baseline Survey of the Environment (G-BASE) project is responsible for providing National Capability in baseline geochemical mapping in the United Kingdom. G-BASE is a long-established systematic geochemical mapping project that is indirectly funded by the British Government through the UK Natural Environment Research Council (NERC). When sampling commenced in the late 1960s, the work was stimulated by mineral exploration and the need to assist geological mapping. The current high-resolution survey is very relevant to contemporary environmental science, and much of the current demand for baseline geochemical information relating to the surface environment is legislatively driven (Johnson et al., 2005). The early years of the G-BASE project were based entirely on rural drainage sampling, utilizing methodologies described in the regional geochemical atlas publications (e.g. BGS, 1993). |
| 30 | Breward et al., 2011, Spatial distribution of trace metals in urban soils and road dusts: an example from Manchester, UK. [Poster] | http://nora.nerc.ac.uk/id/eprint/14183/ | Publication | 59 | No | Poster and relevant G-BASE data are summarised in source: Evidence Number 42 | As part of the Geochemical Baseline Survey of the Environment (G-BASE) project of the British Geological Survey (BGS), 27 UK cities have been surveyed to establish baselines and assess the quality of urban soils. The G-BASE soil geochemical dataset for Manchester forms the basis of this project. |
| 31 | Fordyce,Ander, 2003, Urban soils geochemistry and GIS-aided interpretation : a case study from Stoke-on-Trent. | http://nora.nerc.ac.uk/id/eprint/7018/ | Publication | 59 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | The application of geochemical data to risk-based human exposure and groundwater vulnerability assessments in relation to chemical elements in urban soils The results demonstrate that the geochemistry of soils in Stoke-on-Trent primarily reflects that of the soil parent material. In areas underlain directly by natural bedrock and drift deposits, these play an influential role in soil chemistry, despite the increased incidence of diffuse pollution in urban compared to rural areas. In contrast, element distributions in soils developed over made ground show that this substrate has a major, often detrimental effect on soil quality. |
| 32 | Cave et al., 2018, Using Local Moran's I to identify contamination hotspots of rare earth elements in urban soils of London | http://nora.nerc.ac.uk/id/eprint/520778/ | Publication | 59,64,65 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | In this study, based on the British Geological Survey "London Earth" geochemical survey data the spatial distributions of Ce, La, Nd, Sc, Sm, Yb and Y, and their influencing factors were investigated. |
| 33 | Fordyce et al., 2013, The chemical quality of urban soils in Glasgow, UK, with reference to anthropogenic impacts and current toxicologically-based soil guideline values | http://nora.nerc.ac.uk/id/eprint/501923/ | Publication | 59 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | The survey provides an overview of land quality in Glasgow. |
| 34 | McIlwaine et al., 2017, The relationship between historical development and potentially toxic element concentrations in urban soils | http://nora.nerc.ac.uk/id/eprint/516431/ | Publication | 64,59 | No | Only presents data for Belfast and Sheffield. Potentially uses G-BASE data and relevant G-BASE data are summarised in source: Evidence Number 42 | This research aims to assess if soil PTE concentrations can be used as an 'urbanisation tracer' by investigating geogenic and anthropogenic source contributions and controls, and considering PTE enrichment across historical urban development zones. |
| 35 | Appleton, Cave, 2018, Variation in soil chemistry related to different classes and eras of urbanisation in the London area. | http://nora.nerc.ac.uk/id/eprint/519043/ | Publication | 64,61 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | This study evaluates how soil chemistry has been influenced by different eras of urbanisation within London. |

## B. Evidence Record - Summary of Evidence

| Evidence Number | Evidence Reference | Evidence hyperlink (if available) | Evidence Type | Corresponding search number | Taken forward | Reason for rejection | Brief summary of evidence available from source number |
|---|---|---|---|---|---|---|---|
| 36 | Meng et al., 2017, Spatial distribution patterns of phosphorus in top-soils of Greater London Authority area and their natural and anthropogenic factors | http://nora.nerc.ac.uk/id/eprint/520783/ | Publication | 61 | Yes | | A total of 6467 top-soil samples were collected and analysed by the British Geological Survey, providing basic data for studying the top-soil P distribution patterns and their environmental implications. |
| 37 | Environment Agency, 2007, UK Soil and Herbage Pollutant Survey Report 7: Environmental concentrations of heavy metals in UK soil and herbage | UK Soil and Herbage Pollutant Survey Report 7: Environmental concentrations of heavy metals in UK soil and herbage | Publication | 1,2,3,7 | Yes | | UKSHS report No. 7 series, discusses the range of concentrations of 13 trace metals and metalloids (arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, platinum, titanium, tin, vanadium and zinc) in soils and herbage from 122 rural, 29 urban and 54 industrial sites across the UK. |
| 38 | Environment Agency, 2007, UK Soil and Herbage Pollutant Survey Report 8: Environmental concentrations of polychlorinated biphenyls (PCBs) in UK soil and herbage | https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291162/scho0607bmtb-e-e.pdf | Publication | 1,2,3,7 | Yes | | UKSHS Report No. 8 series, discusses the Environmental concentrations of 26 polychlorinated biphenyls (PCBs) in soils and herbage from 203 rural, urban and industrial sites across the UK. |
| 39 | Environment Agency, 2007, UK Soil and Herbage Pollutant Survey Report 9: Environmental concentrations of polycyclic aromatic hydrocarbons in UK soil and herbage | https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291164/scho0607bmtc-e-e.pdf | Publication | 1,2,3,7 | Yes | | UKSHS Report No. 9 Environmental concentrations of 22 polycyclic aromatic hydrocarbons in soils and herbage from 203 rural, urban and industrial sites across the UK. |
| 40 | Environment Agency, 2007, UK Soil and Herbage Pollutant Survey Report 10: Environmental concentrations of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in UK soil and herbage | https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291147/scho0607bmtd-e-e.pdf | Publication | 1,2,3,7 | Yes | | UKSHS Report No. 10: Environmental concentrations of 17 polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in soils and herbage from 203 rural, urban and industrial sites across the UK. |
| 41 | Gibson et al., 2018, Linkage of national soil quality measurements to primary care medical records in England and Wales: A new resource for investigating environmental impacts on human health | https://www.researchgate.net/publication/325615983_Linkage_of_national_soil_quality_measurements_to_primary_care_medical_records_in_England_and_Wales_A_new_resource_for_investigating_environmental_impacts_on_human_health?_sg=qaZkfaQ7fDdrLiGsah5JNZdwb2xW4_YiU82meVk7RLP8ZzrySLc9Rpf__b5Lx1WIAGHijFa8p6MUrrEB08aypl03f4umFVYH8grUZ_UU.swQxSrS9rf4irQgPV2JKYXRryuxWXiXN_Ooe7JQBN8y1EyGKcwSXpQb93wsM9TkC90U-r52xLMIUFgJPEtm9oA | Publication | 64 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | Study of<br>estimates of the concentrations of 15 elements in the soil contained within each English and Welsh postcode a rea linked to data to the residential postcodes and resident's<br>medical records, to provide estimates of exposure. |
| 42 | Johnson et al., 2011, London Earth topsoil chemical results: user guide. | http://nora.nerc.ac.uk/id/eprint/14402/1/OR11035.pdf | Publication | 65 | Yes | | This report presents a description of the BGS London Earth Topsoil Chemical survey. The purpose of this user guide is to enable those licensing this dataset to have a better appreciation of how the data set has been created and therefore better understand the potential applications and limitations that the dataset may have. |
| 43 | Cranfield University, 2013, NSI topsoil analyses (original) | https://data.gov.uk/dataset/1be058a3-a102-4e71-9735-3d3d5698a3bd/nsi-topsoil-analyses-original#licence-info | Data set | 23 | No | No commercial access, but trace element data is provided by source: Evidence Number 42 | NSI topsoil1 contains a comprehensive record of many of the important elemental abundances in the soils of the UK. This dataset can be used to highlight areas of element abundance, and the links between these and some soil properties. It also provides a pH reading of the soil at that point, which can be used to plot the areas more suitable for the growth of acidic soil loving plants. |
| 44 | Ander et al., 2011, Normal background concentrations of contaminants in the soils of England: available data and data exploration | http://nora.nerc.ac.uk/id/eprint/19958/ | Publication | 33 | No | Relevant G-BASE data are summarised in source: Evidence Number 42 | This report details a Defra commissioned Science and Research Project SP1008 on "Establishing data on normal/background levels of soil contamination in England". This investigated available soil data sets that could be used to assess Normal Background Concentrations (NBCs) for contaminants in soils from England. |
| 45 | Drage et al., 2016, Concentrations of legacy and emerging flame retardants in air and soil on a transect in the UK West Midlands. | https://www.ncbi.nlm.nih.gov/pubmed/26807939 | Publication | 46 | Yes | | Study of 8 sites along a transect of Birmingham, United Kingdom between June 2012 and January 2013; soil samples were collected once at each site. Average concentrations of BDE-209, ΣPBDEs17:183 and ΣPBDEs in soil were 11, 3.6, and 15 ng/g soil organic matter. PBDE concentrations in soil were higher at sites closest to the city centre, however correlations with distance from the city centre were not significant. |
| 46 | Edmondson et al., 2015, Black Carbon Contribution to Organic Carbon Stocks in Urban Soil | https://www.ncbi.nlm.nih.gov/pubmed/26114917 | Publication | 46 | No | Does not cover a chemical of potential concern | Urban top soils are often enriched in BC from historical emissions of soot and have high TOC concentrations, but the contribution of BC to TOC throughout the urban soil profile, at a regional scale is unknown. We sampled 55 urban soil profiles across the North East of England, a region with a history of coal burning and heavy industry. |
| 47 | Heywood et al., 2006, Factors influencing the national distribution of polycyclic aromatic hydrocarbons and polychlorinated biphenyls in British soils | https://www.ncbi.nlm.nih.gov/pubmed/17256505 | Publication | 46 | No | Rural samples, not urban contamination, and thus outside of scope of current review | The polycyclic aromatic hydrocarbons (PAHs) naphthalene, acenaphthylene, acenaphthene, fluorene, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, ideno[1,2,3,-cd]-pyrene, dibenz[a,h]anthracene, benzo[g,h,i]perylene and the polychlorinated biphenyls (PCBs) 8, 18, 28, 29, 31, 52, 77, 101, 105, 114, 118, 123, 126, 128, 138, 141, 149, 153, 156, 157, 163, 169, 170, 171, 180, 183, 187, 189, 194, 199, 201, 206, and 209 were measured in -200 rural soils across Great Britain (GB). |

## B. Evidence Record - Summary of Evidence

| Evidence Number | Evidence Reference | Evidence hyperlink (if available) | Evidence Type | Corresponding search number | Taken forward | Reason for rejection | Brief summary of evidence available from source number |
|---|---|---|---|---|---|---|---|
| 48 | Thums et al., 2008, Bioavailability of trace metals in brownfield soils in an urban area in the UK | https://www.ncbi.nlm.nih.gov/pubmed/18563590 | Publication | 46 | No | Have London-specific information for metals in source: Evidence Number 42 | Thirty-two brownfield sites from the city of Wolverhampton were selected from those with a former industrial use, wasteland or areas adjacent to industrial processes. Samples (<2 mm powdered soil fraction) were analysed, using inductively coupled plasma-atomic emission spectrometry (ICP-AES) for 20 elements. Loss on ignition and pH were also determined. |

# Appendix TN09-C. Evidence Record Template - Evidence Extraction

## Table C: Evidence Record Template - Evidence Extraction

| Evidence reference | Contaminants tested for | Sample collection location and date | Sampling and analysis method | Paper reference |
|---|---|---|---|---|
| 16 | Heavy metals and metalloids: arsenic, cadmium, copper, lead, nickel and mercury.<br><br>Polycyclic Aromatic Hydrocarbons (PAHs): benzo(a)pyrene (BaP).<br><br>Other inorganics: asbestos.<br><br>The study determined normal background concentrations (NBCs) in soils for these substances based on data from previous surveys. NBC were calculated for different domains within England based on geological soil parent material or mineralisation, and land use.<br><br>There was insufficient information available regarding natural concentrations of asbestos in soils and NBCs could not be calculated for this substance. | Data were collected from existing surveys providing that they were:<br><br>- Extensive (at a national scale);<br>- Comprised samples that were systematically collected (so that a broad range of land uses were included); and<br>- Conducted to demonstrable / acceptable levels of quality. | Data for metals, except mercury, were taken primarily from the BGS Geochemical Baseline Survey of the Environment (G-BASE) rural and urban topsoils datasets (37,269 samples) and the English NSI (National Soil Inventory) topsoils (4,864 samples. The latter were reanalysed at the BGS' laboratories by x-ray fluorescence spectrometry so that both data sets were then compatible.<br><br>Data for mercury (1,126 samples) and BaP (371 samples) were taken from a combination of other previous studies. | Johnson et al., 2012, Normal background concentrations (NBCs) of contaminants in English soils: Final project report. |
| 18 | PAHs: Naphthalene, 2-methylnaphthalene, 1-methylnaphthalene, Biphenyl, C2-naphthalenes, Acenaphthylene, Acenaphthene, Dibenzofuran, Fluorene, C1-fluorenes, Dibenzothiophene, Phenanthrene, Anthracene, C1-phenanthrenes + C1-anthracenes, C2-phenanthrenes + C2-anthracenes, Fluoranthene, Pyrene, C1-fluoranthenes + C1-pyrenes, Benz[a]anthracene, Chrysene, C1-benzo[a]anthracene + C1-chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[j]fluoranthene, Benzo[a]fluoranthene, Benzo[e]pyrene, Benzo[a]pyrene, Perylene, Indeno[1,2,3-cd]pyrene, Dibenz[a,h]anthracene, Benzo[g,h,i]perylene, Anthanthrene, Dibenzo[a,i]pyrene, ∑16PAH, ∑50PAH.<br><br>PBCs: PCB 28, PCB 52, PCB 101, PCB 118, PCB 153, PCB 138, PCB 180, ∑7PCB, ∑PCB3, ∑PCB4, ∑PCB5, ∑PCB6, ∑PCB7, Total PCB.<br><br>Descriptive statistics are reported for each PAH and PCB in the data set (mean, median, standard deviation, relative standard deviation, minimum, maximum, number, kurtosis and skew). | Surface soil samples (76 in total) were collected from a 19 $km^2$ area covering Abbey Wood, Thamesmead, Erith, Belvedere and Jenningtree Point, within the Greater London Authority (GLA) administrative area of London. Within this 19 $km^2$ area, four sampling sites were selected every kilometre square.<br><br>Samples were collected in April 2009. | Soil samples were taken at each site from the centre and four corners of a 20 metre square, at depths of 5–20 cm using a Dutch auger. The samples from these five points were combined.<br><br>Samples were freeze-dried, disaggregated, passed through a 2 mm sieve, crushed, extracted and then analysed using GC-MS. | Vane et al., 2014, Polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCB) in urban soils of Greater London, UK. |

## Table C: Evidence Record Template - Evidence Extraction

| Evidence reference | Contaminants tested for | Sample collection location and date | Sampling and analysis method | Paper reference |
|---|---|---|---|---|
| 36 | Phosphorous (as $P_2O_3$).<br><br>Descriptive statistics are reported for P2O3 in London topsoil (mean, median, standard deviation, range, minimum, maximum, number).<br><br>Mean concentrations for London and selected urban soils elsewhere in the UK and also presented. | Soil samples were collected at a density of four samples from every square kilometre, across the GLA administrative area, as part of the same study reported by Evidence Number 42.<br><br>The dates when samples were collected is not reported. | Samples were taken as part of the same study reported by Evidence Number 42.<br><br>A hand-held auger was used to collect 6,467 top-soil samples. The sampling depth was ca. 5-20 cm. At each site, composite samples were collected, comprising 5 sub-samples taken at the centre and four corners of a 20 metre square. Phosphorus concentrations were measured by X-ray fluorescence spectrometry (XRFS) after soil samples were dried and sieved to < 2 mm. | Meng et al., 2017, Spatial distribution patterns of phosphorus in top-soils of Greater London Authority area and their natural and anthropogenic factors. |
| 37 | Heavy metals and metalloids: Cadmium (Cd), Chromium (Cr), Copper (Cu), Manganese (Mn), Mercury (Hg), Nickel (Ni), Platinum (Pt), Titanium (Ti), Vanadium (V), Zinc (Zn), Lead (Pb), Tin (Sn) and Arsenic (As).<br><br>The results for these 13 elements are reported for each of the 87 urban soil samples. | Urban samples were collected from sites in 29 towns and cities in England, Northern Ireland, Scotland and Wales (giving a total (n) of 87 samples) between 2001 and 2002. | Three soil samples were collected for chemical analysis from a 400 $m^2$ area at each urban sample site. The samples were composite samples made up of cores from each point taken to a depth of 50 mm using the bulk density corer.<br><br>Specific preparation and analytical methods were used for different groups of target metals. | Environment Agency, 2007, UK Soil and Herbage Pollutant Survey Report 7: Environmental concentrations of heavy metals in UK soil and herbage.<br><br>[Data for soil properties (pH and organic carbon content) are available in the data and described in Report No. 4: Soil property and radiometric analytical methods in UK Soil and Herbage]. |
| 38 | Polychlorinated Biphenyls (PCBs): PCB 18, PCB 28, PCB 31, PCB 47, PCB 49, PCB 51, PCB 52, PCB 77, PCB 81, PCB 99, PCB 101, PCB 105, PCB 114, PCB 118, PCB 123, PCB 126, PCB 128, PCB 138, PCB 153, PCB 156, PCB 157, PCB 167, PCB 169, PCB 170, PCB 180, PCB 189.<br><br>The results for these 26 PCBs are reported for each of the 87 urban soil samples. | Urban samples were collected from sites in 29 towns and cities in England, Northern Ireland, Scotland and Wales (n = 87) between 2001 and-2002. | The sampling method was the same as described for Evidence Number 37.<br><br>Samples were air-dried and extracted. Analysis was by high-resolution gas chromatography mass spectrometry (HR GC-MS) using splitless injection onto a capillary gas chromatography (GC) column. | Environment Agency, 2007, UK Soil and Herbage Pollutant Survey Report 8: Environmental concentrations of polychlorinated biphenyls (PCBs) in UK soil and herbage. |
| 39 | Polycyclic Aromatic Hydrocarbons (PAHs):<br>1-Methylphenanthrene, 2-Methylphenanthrene, Acenaphthene, Acenapthylene, Anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(j)fluoranthene, Benzo(k)fluoranthene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(e)pyrene, Chrysene, Coronene, Dibenzo(ac)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Perylene, Phenanthrene, Pyrene.<br><br>The results for these 21 PAHs are reported for each of the 87 urban soil samples. | Urban samples were collected from sites in 29 towns and cities in England, Northern Ireland, Scotland and Wales (n = 87) between 2001 and 2002. | The sampling method was the same as described for Evidence Number 37.<br><br>Samples were extracted before analysis by high resolution gas chromatography – low-resolution mass spectrometry (HRGC-LRMS) using programmed temperature vaporisation (PTV). | Environment Agency, 2007, UK Soil and Herbage Pollutant Survey Report 9: Environmental concentrations of polycyclic aromatic hydrocarbons (PAHs) in UK soil and herbage. |

## Table C: Evidence Record Template - Evidence Extraction

| Evidence reference | Contaminants tested for | Sample collection location and date | Sampling and analysis method | Paper reference |
|---|---|---|---|---|
| 40 | Dioxins and Furans: 2378-TCDD, 12378PeCDD, 123478HxDD, 123678HxDD, 123789HxDD, 1234678HpDD, OCDD, 2378-TCDF, 12378PeCDF, 23478PeCDF, 123478HxCDF, 123678HxCDF, 123789HxCDF, 234678HxCDF, 1234678HpCDF, 1234789HpCDF, OCDF.<br><br>The results for these 17 compounds are reported for each of the 87 urban soil samples. | Urban samples were collected from sites in 29 towns and cities in England, Northern Ireland, Scotland and Wales (n = 87) between 2001 and 2002. | The sampling method was the same as described for Evidence Number 37.<br><br>Samples were air-dried and extracted. Analysis was by high-resolution gas chromatography mass spectrometry (HR GC-MS) using splitless injection onto a capillary gas chromatography (GC) column. | Environment Agency, 2007, UK Soil and Herbage Pollutant Survey Report 10: Environmental concentrations of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in UK soil and herbage. |
| 42 | Data are reported for 50 elements:<br><br>Na2O, MgO, Al2O3, SiO2, P2O5, K2O, CaO, TiO2, MnO, Fe2O3, Sc, V, Cr, Co, Ba, Ni, Cu, Zn, Ga, Ge, As, Se, Br, Rb, Sr, Y, Zr, Nb, Mo, Hf, Ta, W, Tl, Pb, Bi, Th, U, Ag, Cd, Sn, Sb, I, Cs, La, Ce, Nd, S, Sm, Hg, Yb<br><br>Descriptive statistics are reported for each element in the data set (mean, median, standard deviation, range, minimum, maximum, number). | Soil samples were collected at a density of four samples from every square kilometre, across the GLA administrative area.<br><br>The dates when samples were collected is not reported. | A hand-held auger was used to collect 6,467 top-soil samples. The sampling depth was ca. 5-20 cm. At each site, composite samples were collected, comprising 5 sub-samples taken at the centre and four corners of a 20 metre square. 50 trace and major chemical elements were measured by X-ray fluorescence spectrometry (XRFS) after soil samples were dried and sieved to < 2 mm. | Johnson et al., 2011, London Earth Topsoil Chemical Results: User Guide. |
| 45 | Data are provided for selected Polybrominated Diphenyl Ethers (PBDEs) and Emerging Flame Retardants (EFRs):<br><br>BDE-28, BDE-47, BDE-99, BDE-100, BDE-153, BDE-154, BDE-183, BDE-209, ∑PBDEs, ∑tri-hepta PBDEs, ATE, ∑DDC-CO, DBDPE<br><br>Results are reported for each sample location. | Eight sampling sites were located on a 60 km transect along the prevailing wind direction from the south-west to north-east, through the city of Birmingham and surrounding conurbation in January 2013. The sample sites displayed different degrees of urbanisation. | Three sub-samples were taken at each location, approximately 1 metre apart within a 1 $m^2$ area, from the top 5 cm of surface soil. The sub-samples were combined, sieved, homogenised, and then stored prior to extraction.<br><br>PBDEs were extracted from soil samples for analysis by a range of methods to target specific compounds. | Drage et al., 2016, Concentrations of legacy and emerging flame retardants in air and soil on a transect in the UK West Midlands. |