NEPM 2013 - Benzo[a]pyrene Potency Equivalency Approach to Reporting Polycyclic Aromatic Hydrocarbons (PAHs)

NEPM 2013: Calculating the Benzo[a]Pyrene Toxic Equivalency Quotient

As of 8th July 2013 Eurofins | mgt will report B[a]P-TPE (Total Potency Equivalents) or alternatively B[a]P-TEQ (Toxic Equivalency Quotient) that are calculated by multiplying the soil concentration of individual carcinogenic PAHs by a standardised benzo[a]pyrene Toxic Equivalence Factor (TEF) to produce a benzo[a]pyrene relative potency concentration, and by subsequently summing the relative potency concentrations for the entire PAH mixture.

Background

In the National Environment Protection (Assessment of Site Contamination) Measure (NEPM 2013) Schedule B (1) - Guideline on Investigation Levels for Soil and Groundwater there has been a new approach to reporting to polycyclic aromatic hydrocarbons (PAH) concentrations.

The major approach advocated by regulatory agencies such as the
• US EPA (1993, 1999),
• California EPA (OEHHA, 1992),
• Netherlands (RIVM, 2000),
• UK (UK Environment Agency, 2002),
• Provinces of British Columbia & Ontario
• Canadian Council of Ministers of the Environment (2008)

for assessing the human health risks of PAH-containing mixtures involves the use of "potency equivalence factors" (PEFs), also referred to as "relative potency factors" (RPFs) or "toxicity equivalence factors" (TEFs). These factors are used to relate the carcinogenic potential of other PAHs to that of benzo[a]pyrene (B[a]P).

Health Investigation Level (HIL) for total PAH is based on the sum of the 16 PAHs most commonly reported for contaminated sites (WHO 1998).

The application of the total PAH HIL must consider the presence of carcinogenic PAHs and naphthalene (the most volatile PAH). Carcinogenic PAHs reported in the total PAHs must meet the B[a]P-TEQ HIL.

Naphthalene reported in the total PAHs must be addressed on the basis of the relevant Health Screening Level (HSL).

Calculation: Multiply the following Individual PAH Concentrations by their TEF Factors

\[
\text{B[a]P-TEQ} = [\text{B}[a]A] \times 0.1 + [\text{B}[a]P] \times 1 + [\text{B}[b]jFA] \times 0.1 + [\text{B}[k]FA] \times 0.1 + [\text{B}[ghi]P] \times 0.01 + [\text{Chry}] \times 0.01 + [\text{D}[ah]A] \times 1 + [\text{IP}] \times 0.1
\]

Benzo[a]Pyrene – Structure

B[a]P TEFs are order of magnitude estimates of carcinogenic potential and are based on the World Health Organization (WHO/IPCS 1998) scheme, as follows:

<table>
<thead>
<tr>
<th>PAH</th>
<th>TEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo[a]anthracene (B[a]A)</td>
<td>0.1</td>
</tr>
<tr>
<td>Benzo[a]pyrene (B[a]P)</td>
<td>1</td>
</tr>
<tr>
<td>Benzo[b+j]fluoranthene* (B[b]jFA)</td>
<td>0.1</td>
</tr>
<tr>
<td>Benzo[k]fluoranthene (B[k]FA)</td>
<td>0.1</td>
</tr>
<tr>
<td>Benzo[ghi]perylene (B[ghi]P)</td>
<td>0.01</td>
</tr>
<tr>
<td>Chrysene (Chry)</td>
<td>0.01</td>
</tr>
<tr>
<td>Dibenzo[a,h]anthracene (D[ah]A)</td>
<td>1</td>
</tr>
<tr>
<td>Indeno[1,2,3-c,d]pyrene (IP)</td>
<td>0.1</td>
</tr>
</tbody>
</table>

*Note: since these two isomers closely co-elute using most contemporary analytical methods, the TEF applies specifically to the level of reporting (LOR), then the TEF was multiplied by half the LOR viz there will always be a positive result.

Reporting

In future Eurofins | mgt reports containing PAHs will now also include the B[a]P-TEQ as well as the sum of the 16 PAHs together with the individual PAHs.

PAH Analytical prices will remain the same.

If you have any questions then please contact your client manager or the contacts listed below.