

Advisory Note

Classification of polycyclic aromatic hydrocarbons

Polycyclic (or polynuclear) aromatic hydrocarbons (PAHs) comprise a group of similar organic compounds comprised of at least two benzene rings. They typically result from the incomplete combustion of organic material (such as coal, petrol, diesel, and wood). PAHs are toxic and carcinogenic. The degree of toxicity and carcinogenicity is dependent on which type (or congener) of PAH it is. PAHs typically occur in mixtures and it is therefore difficult to establish the risk that the mixture may pose.

One method to allow a risk assessment to be undertaken is the use of toxic equivalence factors (TEFs). These allow the toxicity of a mixture of PAHs to be expressed as a single number representing the equivalent concentration of the most toxic or carcinogenic congener. Benzo(a)pyrene (B(a)P) is generally considered the most toxic and carcinogenic PAH.

The TEF represents a ratio of the toxicity of a PAH congener to that of B(a)P. The use of TEFs allows the concentration of PAHs other than BaP to be converted to equipotent concentrations of B(a)P (toxic equivalent). For example, the potency of a PAH having a TEF of 0.01 and having a TCLP concentration of 0.088 mg/L, would have a B(a)P toxic equivalent of 0.00088 mg/L.

The TEQ (toxic equivalent) is calculated by adding the product of the concentration and individual TEF values of each PAH congener. TEFs are applied to all the PAH concentrations in the sample and the sum of these is then compared with the criteria for BaP in Table 2 of IB105.

The TEFs for individual PAHs are

Congener	TEF	Congener	TEF
Benzo(a)pyrene	1	Anthracene	0.01
Dibenz(a,h)anthracene	1	Naphthalene	0.001
Benz(a)anthracene	0.1	Acenaphthylene	0.001
Benzo(b)fluoranthene	0.1	Acenaphthene	0.001
Benzo(k)fluoranthene	0.1	Fluorene	0.001
Indeno(1,2,3,cd)pyrene	0.1	Phenanthrene	0.001
Chrysene 0.01	0.01	Fluoranthene	0.001
Benzo(g,h,i)perylene	0.01	Pyrene	0.001

In the case where a result is reported as less than limit of reporting (LOR) the LOR should be used to calculate the TEQ for that congener. For example if a sample concentration for chrysene was reported as <0.0001 mg/L, after the TEF was applied (0.01 for chrysene) the TEQ would be 0.000001 mg/L. If the sum of the TEQs for a sample exceeds the B(a)P criterion, an additional calculation may be made whereby the LORs are divided by two and the TEF applied. If the sum of the TEQs for a sample still exceeds the B(a)P criterion, an additional calculation may be made whereby the congeners reporting LORs are removed from the calculation. An assessment will be then be made by EPA Division officers as to the risk that the material poses.

Note - The EPA requires that the spreadsheet used to calculate the TEQs must be provided in a digital form as well as the laboratory results, when requests for disposal are made. In the event that the TEQs have been calculated by dividing the LORs by two, or removing the LORs, this must be clearly identified in the spreadsheet.

Further Information

For further information relating to classification of PAHs contact

Controlled Waste Management Officer

(03) 6233 6518